THE BRASS INDUSTRY

LATHROP

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IN

CONNECTICUT

A STUDY OF THE ORIGIN AND THE DEVELOPMENT OF THE BRASS INDUSTRY IN THE NAUGATUCK VALLEY

A thesis presented to the Faculty of the Graduate School of Yale University in Candidacy for the Degree of Doctor of Philosophy

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WILLIAM G. LATHROP

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INTRODUCTION.

THE attempt to write the story of the beginnings and the development of American industrial undertakings is attended with increasing difficulty. Some of these difficulties may be specified.

I. Many enterprises now of notable consequence run back to humble and obscure beginnings. At the time these attracted no attention and the circumstances are entirely lost to record.

II. Two generations ago books were loosely kept or not at all. A sense of perspective was rarely encountered. Matters of little consequence were carefully noted, while facts of permanent value failed of record. Those who engaged in industrial undertakings were neither historians nor philosophers; and historians were occupied with affairs of state.

III. A change in public opinion regarding some phases of corporate activity has recently appeared. This has led to the wholesale destruction of books and papers, some of which are of inestimable value from the standpoint of industrial history.

IV. The records of government investigations, in census and other inquiries, are not of final value and authority. These records were usually formulated and compiled by those who were ignorant of the industrial processes which the inquiry was supposed to cover, and hence are full of inaccuracies and have been made the basis of false conclusions.

V. Those whose personal activity and recollection cover the period of birth and development have largely passed from the stage of action.

These difficulties have all been encountered in this present inquiry.

The census returns and the results of other inquiries undertaken by the government are in the schedules relating to the history of the brass industry singularly misleading. For example; the printed results of inquiries made regarding manufacturing enterprises as ordered by Congress, March 30, 1822, and later under date of January 27, 1824, contain no reference to the existence of the manufacture of tinware in the State of Connecticut; although it is probable that at the time the value of tinware made within the State and sold outside of its boundary exceeded the value of any other manufactured product exported from the State. And in those reports only passing mention is made of the clock industry which in the value of its exported product was second to, even if it did not exceed, that of tinware. In the later returns, the attempt to enumerate the different branches of the brass industry under different schedules, such as brass and copper rolled, brassware and brass casting and finishing has brought about a most unsatisfactory result.

Fifty years ago practically all of the brass mills in the State both rolled brass and manufactured brasswares. This condition persisted until 1900, and still obtains in several important instances. To include the entire product of a given mill in either schedule is misleading. For example; in 1850, there were returned for Connecticut 22 brass foundries with an annual output of $1,250,481, and in 1860, seven brass foundries with an output of $64,000. In 1860, no manufacture of brassware is returned for the State, and, in

1870, only one establishment for the rolling of brass. After 1880, an attempt at a more exact classification was made with results which are hardly more satisfactory. In 1880, the returns for the State are brass and copper rolled, $10,985,471, and brassware, $1,134,884: in 1890, the figures were brass and copper rolled, $6,393,998, and brassware, $10,711,945: and in 1900, the returns were given brass and copper rolled, $29,787,282, and brassware, $9,269,159. It is impossible to take these figures as they stand and reach any valuable result.

This inquiry would have been impossible and the results reached would have been much less valuable, if the writer had not commanded some unusual facilities for investigation. There are only two sources of information now in print of considerable value. These are, first, a brief article by Mr. A. A. Cowles, President of the Ansonia Brass and Copper Company, on "Copper and Brass", printed in 1895, in Volume I of "One Hundred Years of American Commerce", edited by C. M. Depew; and second, the "History of the Town and City of Waterbury", compiled by Rev Joseph Anderson, D.D., in three volumes, printed in 1895. Without this last any attempt now to construct the early history of the industry as it actually developed would be entirely impossible. Dr. Anderson had able collaborators, was a thorough student, had a good historical sense, and was personally acquainted with many of those who had made the industry what it is to-day and whose recollection covered the entire period of its development. His history is second to none of its kind.

The writer wishes to acknowledge his indebtedness to many present and former workmen in the mills who have given him valuable information; particularly to Mr. Fred-

erick J. Kingsbury of Waterbury, who graciously revised this manuscript, whose contributions to Dr. Anderson's history contain practically all of consequence in those volumes as far as it concerns the brass industry, and who stands alone of men now living in his personal acquaintance with those who made the industry what it is and with the conditions under which it was developed; and also to Mr. Charles F. Brooker, President of the American Brass Company, and who is clearly the leading factor in the industry to-day, who has placed in the hands of the writer papers of unique and commanding importance.

CHAPTER I.

INTRODUCTORY.

Localization of the brass industry in Connecticut as indicated by the census returns. Brass; its qualities and history. Ancient and modern processes.

THE brass industry in Connecticut affords a notable example of concentration.* In 1880, 76%; in 1890, 70%; in 1900, 71%; and in 1905, 73% of the rolling of brass and copper and the manufacture of the same was returned by the census as centered in the State of Connecticut.† This concentration has been accomplished notwithstanding the entire absence of raw materials within the State, and without any near absorbing market, except as such has appeared in the course of the development of the industry itself.

The gross product of the brass mills is now more than seventy million dollars a year. There was, in 1900, no example of specialization involving so large a product which was as notable. It is true that in that year 54% of the manufacture of iron and steel was localized in the State of

*See a suggestive study of the theory of concentration as illustrated by the cotton industry in England. "Der Grossbetrieb", G. von Schulze-Gävernitz, Leipzig, 1892. Confer also "Evolution of Modern Capitalism", J. A. Hobson, Chaps. II-IV and "Philosophy of Manufactures", Andrew Ure, Chap. III.

†See census reports 1880 to 1905. See Bibliography for titles. These returns as given are misleading and unsatisfactory. To reach the results above, the figures in the schedules brass and copper rolled and brassware have been added together. Brass casting bears no intimate relation to brass rolling as will be noted. This schedule has been disregarded. See critique in introduction.

Pennsylvania and 45% of the manufacture of boots and shoes was localized in Massachusetts, but the later returns indicate that in both of these lines of manufacture the percentage of concentration is decreasing while Connecticut is retaining her hold upon the brass industry in increasing rather than in diminishing proportion.

Within the State itself the brass industry is by far the most important branch of manufacture. At the beginning of the nineteenth century the textile industry was the most important. It is claimed that the second cotton mill in the country was erected in 1794 at Manchester; being preceded only by Slater's mill at Pawtucket, R. I.* In 1845, when the first statistics which are even approximately satisfactory are available, it appears that the manufacture of woolens was the most important single branch of industry.† At that time the output of the woolen mills alone was 58% larger than the output of the copper and brass mills; and the gross product of the brass industry with its allied branches of manufacture‡ was but 37% of the gross textile product.

*See Gallatin's report, 1810, and "History of Conn.", T. Dwight, Jr., pp. 413-414. "Hist. Amer. Mfrs.", Bishop, Vol. II, pp. 419-421. "Gazetteer of States of Conn. and R. I.", Pease and Niles, Hartford, 1819, pp. 16-17.

†"Report of Sec. of State relative to certain branches of industry", 1839, (Conn.) House Rep. Doc. No. 26. "Statistics of certain branches of industry in Conn.", Oct. 1, 1845, D. P. Tyler, Sec. of State, and later U. S. census returns.

‡The census returns, as already noted, are not consistently classified. Only approximate conditions can be derived. The "allied branches of manufacture" appear as clocks, hardware, needles and pins, hooks and eyes, ammunition and foundry products. The relation of some of these to the brass industry is indicated on the following pages. In Conn. brass machinery is an important item in foundry products and in this State brass enters largely into the manufacture of hardware.

In 1850 the textiles combined were 50% more important, measured by the gross value of product, than the brass industry. For the next three decades this relative development remained constant. Then came a great change. The woolen manufacture declined not only relatively, but absolutely; so that in 1900 the output was actually smaller than in 1880. In 1900 the product of all the textile mills combined did not equal that of 1880. On the other hand in 1890 the brass manufacture took the leading place in the list of Connecticut industries and with its allied branches of manufacture had a gross product which was 25% larger than that of all the textiles. In 1905 the gross product of the rolling mills alone was nearly equal to that of the entire textile industry, and the gross product of the brass industry with its allied branches was more than twice that of the textiles. Of the increase in the value of the annual gross product of all the industries of the State from 1900 to 1905, the brass industry with its allied branches contributed more than one-third, and the total product in 1905 was nearly one-third of the value of the entire manufactured product of the State.

It is the purpose of this paper to study the beginning and the development of the brass industry as thus centered in the State of Connecticut.

Brass is the most valuable alloy known. It bears somewhat the same relation to copper, though for different reasons, that steel bears to iron. Brass is harder than copper and takes a high polish. It possesses a high degree of ductility and of malleability. It is easily fusible and not a good conductor of heat. It is not subject to marked change on exposure to the atmosphere. Since its cost is higher than that of iron or steel, it is not adapted for heavy castings, nor for construction work. It can not be tempered nor hard-

ened like steel, and hence is not adapted for bearings in general,* nor for cutting tools. But for an endless variety of small wares, or for purposes for which its color or durability makes it attractive, it is the most available and widely useful metal now known.

It is impossible to determine when brass was first used. The origin of the English word is lost to record.† An investigation is made particularly difficult because both the Greeks and the Romans used the same word for copper, brass and bronze.‡

Copper was early found on the island of Cyprus and also in Spain and in Cornwall, England.§ Tin was obtained from Cornwall. Both of these metals were articles of Phoenician commerce.|| On the other hand zinc was not known to the ancients, nor was it an article of trade until about the middle of the eighteenth century.¶ Tin and copper are found practically pure in a native state. Zinc is not so encountered.

Copper was softer and more easily worked than iron, and when hardened with tin formed the weapons and tools of

*Alloys of which copper is the chief constituent, other and harder than brass proper, may be used for bearings.

†Article "Brass Founding", Walter Graham, "British Mfg. Industries", edited by G. P. Bevan, London, 1876, p. 126.

‡Brass is the alloy of copper and zinc.

Bronze is the alloy of copper and tin.

§Pliny, "Naturae Historiarum", bk. 34, Chap. 2. "The Industrial Arts", W. Maskell, N. Y., 1876, p. 37 and fol.

||Both copper and tin were articles of Phoenician commerce before 500 B. C. See F. C. Movers, "Die Phoenizer", Vol. II, p. 66 et al. O. Meltzer, "Geschichte der Karthage." Rawlinson, "History of Phoenicia."

¶"The Metallic Alloys", W. T. Brannt, London and Philadelphia, 1889, p. 56.

primitive man. It is probable that this hardening of the pure copper with tin or with other metals is the so-called lost art of tempering copper. Bronze was made and cast in China and Japan earlier than recorded history. Articles of copper and of its alloys have been found in Egyptian tombs dating from before 2000 B. C. In one of the earlier books of the Bible, written by 500 B. C., and possibly depending upon an earlier source, it is stated that vessels of brass were cast for Solomon's temple, erected just after 1000 B. C.* The composition of this metal is of course unknown.

The Elder Pliny in his Natural History devotes a whole book to the metals. He declares that brass was known and used shortly after the founding of Rome.† Numa recognized the workers in copper and its alloys as a trade order. Pliny distinguishes between cuprum, orichalcum and aes, but he does not make the distinction sufficiently plain that we can identify them. He declares that several alloys of copper were in use, but he does not give their composition. Probably this was not known by him. That the most widely used alloy was bronze appears from the coins and ornaments which have survived. That which is the most frequently encountered is composed of from 80% to 85% copper and the rest tin.‡ But after the beginning of the Christian era increasing amounts of lead, zinc, and antimony appear, probably due to impurities in the ore from which the metals were obtained.

About 900 A. D. the art of casting bronze and other alloys of copper was lost, and for three centuries no original work

*I Kings 7:13-39. The Hebrew word apparently applies to copper and bronze, never brass.

†Pliny, book 34, Chap. 2-5.

‡See analysis of ancient coins from 500 to 70 B. C., in Revised Harper's Latin Dictionary, 1879, under "aes."

was made. After 1200 true brass appears, the composition of which was now deliberately undertaken. Copper fuses readily with tin, zinc, lead, antimony and other metals in widely varying proportions, and it does not appear that before this time the effort was made to secure a definite result by carefully selecting the proportions of the metals to be fused.

During the middle ages brass was formed by fusing granulated copper with calamine, the constitution of which was not then known. Calamine is a zinc silicate, a natural ore, found in some cases close to copper ore. When it is heated with copper globules of brass appear. The process is improved by adding charcoal and by granulating the copper. To this end molten copper is poured into water. Because both calamine and natural copper vary somewhat in richness, the product at the first was an uncertain compound. After a time a desired result was secured by remelting the first product and adding calamine or copper as indicated.

It has been quite reasonably suggested that the production of brass thus, thought to be an entirely new metal, and possessing widely differing properties with slight variations in the constituent materials, was one of the factors inspiring the search for the philosopher's stone, which should transform base metal into gold.

About the middle of the eighteenth century the composition of calamine became known, and zinc appeared in metallic form in the market.

In 1781 the modern process of making brass by the direct fusion of copper and zinc was invented by James Emerson in England.*

*Article on "Brass Founding", Graham, "Brit. Mfg. Ind.", Bevan, p. 134.

Brass is ordinarily composed of two parts of copper to one of zinc, but frequently for special purposes these proportions are varied and other metals are introduced. Even in the present trade much confusion remains because of the use of secret formulas, practically the same mixture being given different names by different manufacturers or in different localities.

For casting lead is added, which makes the casting sharper. When antimony is present the alloy is harder but more brittle. Lead diminishes ductility. Malleability and ductility vary with different proportions of the metals. Some compounds are malleable and may be rolled when hot, some when cold, and some not at all. Copper itself is always rolled hot, and brass is rolled cold.*

In ancient times and during the middle ages bronze, brass and other alloys were cast. The modern process is first to cast the metal in the form of pigs or ingots which are then rolled into sheets or strips, then blanks are cut which are manufactured into wares as desired.

The selected metals in the proportions chosen are weighed and placed in crucibles holding a hundred pounds or more. Copper melts at about 2,200° Fah., and zinc at 770°. Brass melts at from 1,000° to 2,000°. It might be expected that there would be some loss of zinc by volatilization or combustion, and this is experienced to some degree; but in practice the zinc combines with the copper so readily that the loss is not large. When brass is remelted there is a loss of weight of from 4% to 6%.

*For lists of different alloys and their properties see Article by Graham above, p. 134. Spon, "Encyclopedia of Indust. Arts", Vol. I, pp. 321-323. W. T. Brannt, "The Metallic Alloys." Arthur H. Hiorns, "Mixed Metals or Metallic Alloys", London, 1901, pp. 100-130.

The molten metal is poured into moulds or run into pigs between marble slabs. The dimensions of the pigs are determined by the use for which the metal is designed. Brass for rolling is never cast in sand. As brass is rolled it becomes hard and brittle and a scale of oxide forms. The scale is removed by running the sheets into dilute sulphuric acid and the hardness is corrected by annealing.

It is the manufacture of brass by such modern processes,* thus briefly indicated, which was introduced into Connecticut shortly after the beginning of the nineteenth century and which at the close of the century had become the most important industry in the State.

*See Article by A. A. Cowles in "100 Years of American Commerce", C. M. Depew, Vol. I, p. 335. "Great Industries of the U. S.", pp. 1048-1054. Scientific American, May 1, 1880.

CHAPTER II.

Early Industrial Conditions in Connecticut.

Agriculture and its limitations. Emigration. Trade and its difficulties. Attempts to develop mineral resources; lead, copper, iron. Other early industrial ventures. Household industry and its development. Tinware, clocks, pewter britannia and German silver.

THE early settlers of Connecticut, as of the other colonies, were agriculturalists. The soil, especially in the river valleys, was good, returns were attractive, and hence the clearing and the cultivation of the soil was the first effort. The result was a scattered population. The State remained essentially rural and agricultural until well after 1800.

It is the uniform testimony of travelers of the period that the people of the State lived well; they were well fed, warmly clad and comfortably housed.* The abundance of provisions in contrast to prevailing conditions in England and Europe occasioned remark. But it is equally certain that commodities other than the bare products of the land were much less in evidence. In the earlier period such posses-

*"Letters of an Englishman" in Conn. Magazine published in 1801. "Travels in North America in years 1827 and '28", Capt. Basil Hall, Phila., 1829. See also "The American Gazetteer", Jedidiah Morse, Boston, 1797. "Town and City of Waterbury", Anderson, Vol. I, pp. 520-547. "Travels through the Northern parts of the U. S. in 1807 and 1808", E. A. Kendall, Vol. I, pp. 85-88, 231, 236, 248, 311. "History of Conn.", T. Dwight, Jr., Vol. I, pp. 135, 136, 268, 269. "Society in America", Harriet Martineau, Vol. II, p. 220. "View of the U. S. Historical, Geographical, etc.", Wm. Darby, p. 492.

sions as beds, "sithes", saws and axes were carefully handed down from father to son.* Later on warming pans, andirons, wooden trenchers, pewter basins and other vessels, simple tools, such as tongs, a brass skillet, chisels, dividers, a vise,† also bells, "a walking staff with a silver head", appear as carefully treasured. Articles of wearing apparel other than coarse homespun are severally bequeathed down to silk aprons and ribbons, cambric gowns, linen handkerchiefs and a fan. Men, too, valued coats with brass buttons, silver buckles, beaver hats, silk jackets and breeches, boots and spurs.‡ After the Revolution chaises, watches, clocks, silver cups, tankards and other plate were taxable and found only in the possession of the richer families.§

Before 1800 the river valleys were well settled,|| and the possibilities of the agricultural development of the State under conditions which then prevailed were pretty well defined and found to be limited. There were two possibilities of improvement: to emigrate to the North or West, where the agricultural opportunities were said to be more promising; or to enlarge economic opportunity by engaging in trade or in manufacturing.

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*"New Haven Colonial Records", 1653-1664, Hoadley, pp. 258, 358, et al.

†"Town and City of Waterbury", Anderson, Vol. I, p. 371.

‡See e. g. "History of Norwich, Conn. to the year 1866", F. M. Caulkins, pages from 2nd. edition, 1874, pp. 157, 175, 191, 248, 333.

§"North Haven Annals", S. B. Thorpe, New Haven, 1892, p. 258.

||"Travels in No. Amer. in the years 1780, 1781 and 1782 by the Marquis de Chastellux. Translated with notes by an English gentleman who resided in America at that period", 2 Vols., Dublin, 1787, Vol. I, pp. 44-47. "Remarks made on a short tour between Hartford and Quebec in 1819", James Silliman, New Haven, 1824, pp. 11-36.

The first response which the natives of the State made to the limitation of agricultural possibility was emigration. At the time it was estimated that 700,000 had emigrated by 1820.* But since the movement could not have been large before the Revolution, and since the population of the State did not exceed 250,000 until about 1800, this estimate must be a very liberal one. That the emigration was, however, proportionately large is apparent from the following table, which gives a comparison of the increase of the population of the State of Connecticut in the first column, with that of the whole United States in the second.†

1756-1774	51.5%	——
1774-1790	20.2%	——
1790-1800	5.5%	35.1%
1800-1810	4.3%	36.4%
1810-1820	5.1%	33.1%
1820-1830	8.1%	33.5%
1830-1840	4.1%	32.7%
1840-1850	19.6%	35.9%
1850-1860	24.1%	35.6%
1860-1870	16.8%	22.6%
1870-1880	15.5%	30.1%
1880-1890	19.9%	24.9%
1890-1900	21.7%	20.7%

The gross increase in the population of the State in the

*"New Travels", 1788, J. P. Brissot de Warville, London, 1792, Vol. I, pp. 135, 136. "Gazetteer of States of Conn. and R. I.", Pease and Niles, Hartford, 1819, p. 11. Confer also "Early Transportation and Banking Enterprises of the States, etc.", Prof. G. S. Callender in Jour. of Economics, Vol. 17, pp. 115, 117.

†See "Travels through the Northern parts of the United States in 1807 and 1808", E. A. Kendall, 3 Vols., N. Y., 1809, Vol. I, pp. 194, 195; and census reports of U. S. from 1790.

eighteen years from 1756 to 1774 was 67,000, and in the eighteen years from 1782 to 1800 was 42,000, while during the twenty years from 1800 to 1820 the increase was but 24,000, and from 1820 to 1840 but 35,000. During the forty years from 1800 to 1840 the gross increase was less than 59,000 as compared with 67,000 in the eighteen years from 1756 to 1774. After 1840 a decided change appears, the increase being over 60,000 in the next decade, and this rate was well maintained except during the Civil War, rising to above 160,000 in the last decade of the century, when for the first time the rate of increase was larger than that of the country as a whole.

Further evidence of depopulation may be noted. In 1782 it appears that there were nine towns with a population of 6,000 and upwards, containing 25.5% of the total of the State. They were in order, New Haven, with 7,966, Norwich, New London, Farmington, Hartford, Stratford, Woodbury, Fairfield and Stonington. In 1800 there were six with 5,000 or more, containing 12.4% of the total. These were Stonington, with 5,437, Hartford, New Haven, New London, Norwalk and Middletown. In 1820 there were only three with more than 5,000, together 7.9%of the total population of the State, New Haven, Hartford and Middletown.

Those who emigrated did nothing to solve the question of the local needs; they rather evaded it.

For those who remained the escape from the limitation of economic opportunity was to enlarge the scope of industry by engaging in trade* or in manufacturing. Trade was not

*Brissot de Warville in his observations on the commerce of America with Europe argues that America must engage in trade because "having no manufactures they cannot themselves supply these wants, and they can have no manufactures for a long time to come." 2nd. Volume of travels, London, 1792, p. 66.

promising. Agricultural products were available for export.* New Haven was early interested in trade with the West Indies, but this was more largely in the hands of New York and Boston merchants and practically controlled by them.† New London and Stonington were interested in whaling,‡ but this did not contribute to more than local prosperity. Away from the coast conditions were unfavorable for trade. The possibilities of trade by barter were limited, and there was but little coin or currency in circulation. The interior towns were only scattered villages. In 1780, Hartford, one of the most important of the interior settlements, consisted only of one long street parallel with the river and did "not merit attention either in traveling through it or in speaking of it."§ Internal means of communication were either absent or were very defective. Transportation charges were prohibitive. Imported goods consisting mostly of large value in small bulk might have found their way in, but bulky farm produce was not easily carried out. As late as 1780 the roads were so bad as to admit of a progress of only ten miles a day, even for a light load.|| During the next decade considerable improvement was made, so that a single horseman under very favorable circumstances could make

*"The United States Gazetteer", Joseph Scott, Phila., 1795. "Travels", E. A. Kendall, Vol. I, p. 9. "Travels", Brissot de Warville, Vol. II, pp. 66-75 et al. As late as 1840 the State relied upon agricultural products in the main for export. "Hist. of Conn." T. Dwight, Jr., pp. 268, 269.

†"Belcher papers", Collections Mass. Hist. Society, Sixth Series, Vol. VI.

‡"History of Conn.", T. Dwight, Jr., p. 445.

§"Travels in N. A. in 1780-82", Chastellux, Vol. I, p. 36; also pp. 21, 48.

||"Travels", Chastellux, Vol. I, p. 36; II, pp. 296, 452.

fifty miles a day.* But it was not until 1790 that turnpikes began to be constructed, and the incorporation of turnpike companies was not begun until just before 1800.† After the beginning of the century decided improvement was made, so that by 1820 the roads were in fairly good condition.‡ Capital which might have been available for other purposes was at the turn of the century demanded for the improvement of transportation,§ and just as the problem was in a fair way of being solved the policy of the national government dammed the stream of foreign commerce. After 1815 an active and profitable internal trade was carried on.

Of the period during which foreign trade was largely stopped, a contemporary, in 1819, wrote: "The late war had a favorable influence in stimulating the naturally enterprising spirit of our citizens to engage in various manufacturing pursuits, thereby developing our resources and opening a more extensive and varied field of industry. Many of the germs of manufacture, to which the war afforded life and growth, have been blighted with the mildew of foreign goods with which the peace inundated the country. Many establishments have fallen, and many individuals who had invested their whole capitals in the business have been sacrificed and others severely injured. The seeds of manufacture were sown in this country during the war. Those who engaged

*"Travels", Brissot de Warville, Vol. I, p. 143.

†"Travels", Kendall, Vol. I, pp. 97, 129, 235, 255, 302, 303.

‡"Remarks on Tour", Silliman, pp. 11-36.

§Prof. G. S. Callender, "Early Transportation and Banking Enterprises of the States, etc." in Journal of Economics, Vol. 17, p. 131 fol. See Note *, page 23.

in the business upon a moderate scale and conducted it upon principles of economy have best withstood the shock."*

While it is true as will be later noted that many of the seeds from which the important manufacturing establishments of the State developed were planted about 1800, yet it is not true that this was the first indication of such enterprise on the part of the people of the State. From the early settlement of the colony attempts were made to supplement its agricultural products by a development of its mineral resources, and during the colonial period several attempts were made to establish manufactures.

The mineral resources of the State were at the first thought to be very promising. It has been said that every known mineral could be found within its limits, but in quantity just under the point of profitable production.† Copper and iron were widely encountered. An ore containing lead, zinc, copper, silver and bismuth was exposed near Middletown.‡ Cobalt was discovered in Chatham,§ manganese in Lebanon,|| and gold, silver, nickel and copper in Ledyard.¶ The only deposits which were ever continuously worked were the lead mines in Middletown, copper in Granby and iron in Salisbury and vicinity.

The lead mines at Middletown were exploited by English-

*"Gazetteer of the States of Conn. and R. I.", Pease and Niles, pp. 135, 136.

†"In Olde Connecticut", C. B. Todd, N. Y., 1906, p. 156.

‡"Historical Collection of the part sustained by Conn. during the war of the Revolution", R. R. Hinman, Hartford, 1842, p. 264. "Centennial Address", D. D. Field, Middletown, 1853, pp. 70, 159-161.

§"Travels", T. Dwight, Vol. I, pp. 34, 35. "Centennial Address", Field, pp. 274-276.

||"Travels", T. Dwight, Vol. I, pp. 34, 35.

¶"History of the town of Ledyard", Avery, 1901, p. 10.

men before the Revolution. At the outbreak of the war the mines were seized by the colony and a few hundred pounds of metal were used for bullets. But in 1778 operations ceased, because considered unprofitable, and were never again resumed.

In 1705 a vein of copper ore was discovered in Simsbury. In 1712 another vein was exposed in what is now Cheshire.* Other undertakings were for a short time carried on in East Hartford,† Bristol‡ and at other points. At Cheshire the paying ore lay only in small pockets and the shafts were soon abandoned.§ More extensive operations were carried on at Simsbury.|| The oldest mining charter in the country was given in 1709 to the company which worked this mine.¶ For thirty years from 1707 these operators were actively en-

*T. Dwight, "Travels", Vol. II, p. 50. "Complete History of Conn.", Benj. Trumbull, D. D., 1818, Vol. II, pp. 40-46. "History of town of Hamden", Blake, pp. 70-74.

†"East Hartford, Its History and Traditions", Goodwin, Hartford, 1879, p. 157.

‡"Centennial Celebration of Incorporation of town of Bristol", p. 46. Connecticut Quarterly, Vol. III, 1897, p. 23.

§"Historical Sketches of Meriden", G. W. Perkins, pp. 76-82. "Olde Historic Homes of Cheshire", Brown and Paddock, 1895, pp. 133, 134.

||For the Simsbury mine see; "History of Newgate of Conn.", R. H. Phelps, Albany, 1860. "Connecticut Historical Collections", J. W. Barber, 2nd. edition, New Haven, 1837, pp. 93-96. "In Olde Connecticut", C. B. Todd, pp. 153-156. Farmington Magaine, Vol. II, No. 2, Apr., 1902, p. 11. The profits of the Simsbury mine accrued to capitalists elsewhere. Much ore was shipped by Boston merchants. For notices of such shipments see "Belcher papers", in Collections Mass. Hist. Society, Sixth series, Vol. VI, pp. 30, 40, 50, 80, 124, 269 et al. Also "Hist. Amer. Mfrs.", Bishop, Vol. I, pp. 508-510.

¶"The Great Industries of the U. S.", p. 480.

gaged. They reported that £15,000 had been expended by them. The legislature passed several bills designed to encourage the workers. Since the laws of England forbade smelting the ore here, the product of the mine was shipped thither, many consignments being made. Small amounts were smelted here, notwithstanding the prohibition. After 1737, the returns not being satisfactory, the energy of the undertakers flagged and the deposit has been worked but intermittently since. For a short time in 1837 and again in 1857 operations were carried on.

The iron mines were more to the purpose. The first iron produced in Connecticut, as elsewhere in New England, was smelted from bog ore. John Winthrop erected the first smelter in the colonies at Lynn, Mass., in 1644.* Five years later he located the first in Connecticut at Montville.† In 1655 another plant was erected at East Haven,‡ and many others were subsequently located, some of which continued in operation until well after 1800.§ Notwithstanding the Act of Parliament which ordered that after June 24, 1750, the colonies should be forbidden to erect or to operate forging, rolling or slitting mills, or to make steel, it appears that many forges were in operation all through the colonial period.||

The important development of iron mining and manufac-

*"Hist. Amer. Mfrs.", Bishop, Vol. I, p. 472.

†"History of Montville", H. A. Baker, Hartford, 1896, p. 622.

‡"The East Haven Register", Stephen Dodd, 1824, pp. 23-27. "History of the Colony of N. H. etc.", Lambert, 1838, p. 84.

§"History of Middlesex County", N. Y., 1884, pp. 178, 566. Digest Amer. Mfrs., 1823.

||"Travels", Kendall, Vol. I, p. 231. "History of Norwich", Caulkins, p. 606. Preface, "History of American Clock Business", Jerome. "Hist. Amer. Mfrs.", Bishop, Vol. I, p. 514, 507.

turing was in Litchfield County.* Here is found an extensive deposit of brown hematite or limonite ore. Just after 1730 these beds were located and explored. In 1734 the first furnace and forge was erected,† and in 1762 another extensive plant was organized by Ethan Allen of Massachusetts.‡

At the outbreak of the Revolution the works in the vicinity of Salisbury were seized by the Government and it was ordered that they should be operated for the good of the cause.§ A committee of safety expended £1,450 in fitting them up and a considerable force was constantly employed. These men were freed from militia engagements, and the plant was considered one of the most important in the hands of the Government. Here the cannon for the "Constitution" were cast, with other war material such as cannon, shot and shell, anchors, pots, kettles and also the chains which were stretched across the Hudson River.|| Just after the Revolution these ore beds were thought to be the most important in the country, and it was said that Salisbury was destined to become the Birmingham of America.¶ After 1800, however, Pennsylvania came to the front and the Connecticut production rapidly dwindled into insignicance.**

*"History of Kent", Atwater, pp. 86-99.

†"Historical Address at the Commemoration of 100th Anniversary of Salisbury", Samuel Church, New Haven, 1842, p. 53. "Hist. Amer. Mfrs.", Bishop, Vol. I, p. 511.

‡"Historical Address", Church, p. 54.

§"Historical Address", Church, pp. 42, 43. "Historical Collection", Hinman, pp. 239, 264, 265. "Hist. Amer. Mfrs.", Bishop, Vol. I, pp. 511, 512.

||"Life of Jonathan Trumbull", Stuart, pp. 255, 256.

¶"Hist. Amer. Mfrs.", Bishop, Vol. I, p. 512; Vol. II, p. 259.

**Bishop states that the first iron foundry in Pittsburg was erected in 1804. Bishop, Vol. III, p. 105.

Impelled by their need the colonists from the early days sought to establish industry other than agricultural. Because of the lack of capital* and as well in view of the absence of a large or reliable market, the first adventurers generally looked to the colony for assistance. What appears to be the first patent granted by either the Connecticut or New Haven colonies is dated May 25, 1647. At that time a certain Mr. Whiting was given the exclusive right to take whales in the Connecticut River for seven years, he being granted two years in which to prove his ability to exercise this right.† The subsequent value of this concession does not appear. With this worthy precedent many were the efforts to secure aid from the colony for doubtful undertakings.

No original papers referring to the setting up of manufactures in the state survive for the period before 1716. But all through the eighteenth century the Colonial Assembly was appealed to for assistance. These enterprises, however, although some of them were undertaken and prosecuted with commendable energy, were in general unsuccessful. Many of the promoters according to their own

*Kendall in 1807 notes the lack of capital in Conn. as compared with Boston and N. Y. "Travels", Vol. I, p. 139. See also "Sketch of Internal Condition of U. S. A. Result of observations in 1810-12 and 1819", By a Russian, Baltimore, 1826, pp. 115, 116. The enterprises in the 18th century which required considerable capital were financed by men from other colonies. John Winthrop represented Mass. capital. Iron smelting and Simsbury copper mine drew from outside capital. The Middletown lead mines were exploited by Englishmen. In Connecticut capital seemed more scarce than in Massachusetts.

†"Public Records of the colony of Conn. prior to union with the N. H. colony, 1636-1665", J. H. Trumbull, Hartford, 1850, Vol. I, p. 154.

statements lost heavily, and they were generally shortly abandoned. It is not surprising that many surrendered and emigrated. Notwithstanding these unfortunate precedents there were to be found shortly after the Revolution at several points within the State the beginnings of many enterprises which later turned the tide of population and which raised Connecticut to the high rank which it now occupies as an industrial State. These beginnings are to be found in household industry, rather than in the professedly larger undertakings.

All through the eighteenth century the household manufacture of iron and of the textiles was carried on largely and successfully.* From the smelters iron was secured which was forged into spades, plows and other farm utensils with the assistance of wayside forges which abounded, and the village blacksmith, if one was at hand.† The strips of iron as they came from the slitting mills were hammered into nails during the winter or as needed.‡ The household manufacture of the textiles was universal. This was the main source of the supply of the needs of the household.§

*For such industry see: "General History of Conn. prior to the Revolution", By a gentleman of the province, London, 1781, Reprinted New Haven, 1829, pp. 199, 200 et al. Kendall, "Travels", Vol. I. Chastellux, "Travels", Vol. I, pp. 38, 39; II, p. 447 et al. Brissot de Warville, "Travels", Vol. II, p. 66 et al. Also Gazetteers: Scott, 1795; Morse, 1797; Pease and Niles, 1819. Household industry survived until towards 1850. "Hist. of Conn.", Arthur & Carpenter, 1854, Reprinted Phila., 1872, p. 284.

†Kendall, "Travels", Vol. I, p. 231.

‡See Note ||, page 21.

§Hamilton in 1790 reports that from 2-3 to 4-5 of all clothing was supplied by the household. Gallatin in 1810 repeats this estimate, applying it however particularly to the country. See respective reports. See also "Society in America", Martineau, London, 1837,

As a direct development of this, in 1810 Connecticut was farther advanced than Massachusetts in the manufacture of textiles, and this for three-quarters of a century retained first place in the industry of the State.* Until well towards the middle of the century the making of boots and shoes was more nearly related to the household than to any other form of industry.†

But in this development of iron working and of the textile manufacture conditions in Connecticut did not differ from those which prevailed in the other colonies. There were, however, here some unique developments of household industry. The brass industry itself runs back into the household, as will be noted in the following chapter. This, however, was only one of many ventures which were made about the beginning of the nineteenth century. As several of these later came into close connection with the rising brass industry they will first be considered.

The first in time and as well the most important both because of its immediate history and because of its indirect influence upon other manufactures was the making of tinware.

The manufacture of culinary vessels and household articles from sheet tin was begun by William Pattison and his brother Edward, who coming from Ireland settled in Berlin

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Vol. II, p. 229. Kendall, "Travels", Vol. I, p. 89. "General Hist. of Conn.", By a gentleman of the province, N. H. reprint, 1829, p. 199. Not only was the weaving of wool and flax carried on in the household, but also of silk. Kendall, "Travels", Vol. I, p. 251.

*Bishop, "Hist. Amer. Mfrs.", Vol. II, pp. 78, 79, 419-421. Gallatin's Report, 1810.

†"History of Conn.", Arthur & Carpenter, Phila. reprint, 1872, p. 284. "Statistics of certain branches of industry in Conn.", Oct. 1, 1845, D. P. Tyler, Sec. of State.

about 1740.* After supplying their neighbors they reached out for a larger market. Their wares were sold from house to house, at first by the brothers themselves, afterwards by peddlers whom they employed. As it was easy to make a much larger product than the local market could absorb, for some time the brothers kept the manufacture to themselves. After 1760, however, they consented to train a few apprentices, and after the Revolution their peddlers extended the scope of their operations. At first on foot, then on horseback and finally by wagon they sold their wares all over the United States. After a little a type of wagon was perfected for this trade. A one or two horse vehicle was developed to carry prominently displayed samples of wares, strongly built, which was driven wherever the roads allowed. The peddlers ranged from Montreal and Quebec to Charleston and through the South, also far to the West, even across the Mississippi.† They traded by sale or by barter, making use of every means which ingenuity could suggest to place the goods which they happened to have. These Connecticut peddlers were for the South and West the original

*"Travels in N. E. and N. Y.", Dwight, Vol. II, pp. 51-55; IV, p. 483. "Gazetteer of the States of Conn. and R. I.", Pease and Niles, pp. 15, 57. "History of New Britain", Camp, pp. 266, 267. "Connecticut, a Study of a Commonwealth-Democracy", A. Johnston, Boston, 1903, pp. 357-359. "Hist. Amer. Mfrs.", Bishop, Vol. I, p. 575.

†Many references are made to the methods of these peddlers and the extent of their operations. See in addition to references under Note above, the following: "Travels through U. S. and Canada in 1818 and 1819", John M. Duncan, N. Y. and N. H., 1823, p. 107. A good description of the sharpness of the trader. Also "Travels", Kendall, Vol. I, p. 129. The wagon described. Also "A Century of Meriden", Gillespie, Pt. III, p. 39. This organization continued till 1850. "Hist. of Conn.", Arthur & Carpenter, Phila. reprint, 1872, p. 284.

"Yankees" and became a recognized institution all through the country.

The establishments in Connecticut were not operated continuously in the earlier period. The market did not permit of it. The employers opened their shops during the summer in the North, and during the winter they moved to Philadelphia and Baltimore, where they continued their operations. After 1800, however, the selling of the product was fully organized, and for forty years and more Connecticut was the center of this industry.* In 1810 two-thirds of the product of the country came from this State.† In 1832 still Connecticut controlled the Southern and Western trade.‡ In 1845 after iron manufactures, brass wares and clocks, the making of tinware was the most important metal working industry in the State.§ But after the middle of the century this manufacture declined and practically disappeared, for in 1885 only two or three small shops with two or three hands each remained.||

During its most prosperous period, however, this industry

*"Travels", Dwight, Vol. IV, p. 490. "Hist. of Conn.", T. Dwight, Jr., p. 413.

†See Gallatin's report, Amer. State Papers, 1832, Finance, Vol. II, p. 429, and Tench Coxe, "Tabular Statement" and "Series of Tables." The sheet tin was all imported. In 1815, 10,000 boxes were used by the Berlin shops alone. "Travels", Dwight, II, p. 55. In the year ending Sept. 30, 1823, sheet tin was imported at an invoice value of $386,540. "Statement of the cost of mfr., etc.", 18th Cong., 1st. Sess., Doc. 72, Feb. 12, 1824.

‡"Documents relative to mfrs. in U. S.", 1832, 1st. Sess., 22nd. Cong., Doc. 308.

§"Statistics of certain branches of industry in Conn.", Oct. 1, 1845.

||"Memorial Hist. of Hartford County", J. H. Trumbull, Boston, 1886, Vol. II, p. 22.

was advanced hardly beyond the household stage. As late as 1845 under the most favorable conditions there were barely ten workmen to each establishment.*

The most valuable contribution which the tinware manufacture made to the industrial history of the State was the trade organization which it perfected. The itinerant vendors, who were at the first interested in the main in the sale of tinware, found their occupation continued in the sale of other small articles provided for them by Connecticut enterprise. The sale of the product was decidedly the more important end of the business. In 1815 single shops sent out as many as twenty or thirty of these peddlers,† in some cases twice as many as the workmen in the home establishment. Until 1850 the peddlers of Connecticut merchandise were known all over the country, and the part which they played in the marketing of the local manufactures of small wares can hardly be exaggerated.‡ In 1850 their stock in trade was clocks, copper tin and brass wares, hats, shoes, combs, axes, buttons, saddlery and paper. These wares were even then generally made in small quantities in small establishments with limited capital, but the aggregate of production was large.

Another industry, developed from the household, with a much more brilliant history than the making of tinware, was the clock manufacture. Before 1800 clocks were made of wood. It is known that they were made on a small scale, in the household, in several places in the State; for example, in

*"A Century of Meriden", Gillespie, Pt. I, pp. 346-360.

†"History of New Britain", Camp, pp. 266, 267.

‡"Hist. of Conn.", Arthur & Carpenter, Phila. reprint, 1872, p. 284.

Waterbury, Bristol, Meriden, Plymouth and Winchester.* The parts were roughly cut by hand saws and finished by hand lathes and knives. The finished article was quite expensive. Good wooden clocks cost in the market from $20 upwards. A seven foot hall clock in 1810 cost $20 for the works, and as much more for the case. As late as 1825 a peddler could sell such a clock for $100 in Louisiana.† As the actual cost of the raw material was small, clock making was considered a profitable trade. A small maker would finish two or three clocks, then peddle them on horseback, returning to his shop when they were sold.‡

Before 1800 efforts were made to use brass for the working parts. The wheels were cast and finished by hand.§ This effort was stimulated by the difficulty in securing seasoned wood which would resist the influence of dampness; which difficulty made the export of clocks impossible and interfered seriously with the Southern trade. In 1818 again

*"Travels", Dwight, Vol. II, p. 368. "Gazetteer", Pease & Niles, p. 15 et al. "Hist. of the American Clock Business", Jerome, N. H., 1860. "Hist. Amer. Mfrs.", Bishop, Vol. II, p. 377 et al. "Memorial History of Hartford County", Trumbull, Vol. II, p. 57. "Hist. of the town of Plymouth, Conn.", F. Atwater, Meriden, 1895, pp. 219-239. "Recollections of a N. E. town" (Meriden), Breckenridge, Meriden, 1899, pp. 6-9. "History of Waterbury", Bronson, p. 380.

†"Hist. Amer. Clock Business", Jerome, pp. 18, 51. It was the practice of the peddlers to charge all that the traffic would bear.

‡"History of Amer. Clock Business", Jerome, pp. 35-37. Clocks were sold to some extent by peddlers all through the South. As late as 1840 the trade was actively in their hands. See Jerome, pp. 46, 54, 70.

§"History of Town of Plymouth", Atwater, p. 220. Clocks with works of cast brass were at this time imported from Germany. Such importation had begun early in the eighteenth century and the trade continued until after 1830.

an attempt was made to use brass and iron, the casting process still being used.* But the result was not satisfactory and the enterprise was abandoned. The cost was prohibitive, such clocks being worth from $40 to $75.† The finished article was heavy and unwieldy and could not compete with imported metal clocks.

In 1793, Eli Terry,‡ who had learned the trade from an Englishman, came to Northbury, then a part of Waterbury, and began the making of wooden clocks by the old hand methods.§ Two years later, in 1795, Northbury was incorporated as Plymouth. On Nov. 27, 1797, he received letters patent on certain improvements in the manufacture and endeavored to establish himself in the business.|| He moved from Plymouth hill into the valley by the river where Thomaston now is and became the first extensive maker of clocks in the State and eventually raised the industry from the household stage. In 1802 he began the use of water power.¶ In 1807 he introduced the making of interchangeable parts,** and undertook to make 3,000 clocks in one year.

*Pease and Niles, "Gazetteer", 1819, p 59. Jerome, "History", p. 40.

†"History of Waterbury", Bronson, p. 436.

‡Terry was born in South Windsor, Ct., Apr. 13, 1772. "Hist. Plymouth", Atwater, p. 219. "Hist. Amer. Mfrs.", Bishop, Vol. I, p. 520. See also article in Scientific Amer. Supplement, Vol. 27, June 15, 1889.

§Census 1900, Mfrs. Pt. II, Vol. VIII, p. 78. At least one clock made by Eli Terry with wooden wheels for the tower of the Congregational Church in Plymouth is still running in good order.

||Bishop, "Hist. Amer. Mfrs.", Vol. III, p. 75.

¶Bishop, "Hist. Amer. Mfrs.", Vol. III, p. 97.

**"History of Plymouth", Atwater, p. 221. Jerome, "History", pp. 16, 36. "American Clock Making", Terry, Waterbury, 1872, p. 3.

This was thought to be a larger output than any other shop in the country and was considered an impossible task. In 1808 Terry sold his Thomaston shop to Seth Thomas and the output increased notably. In 1810 in Litchfield County alone 4,000 wooden clocks were made,* which output was increased threefold during the next decade.†

Mr. Terry was constantly working to improve processes designed to cheapen the product. In 1814 he invented a shelf clock, still of wood, which could be sold at a profit for $15; and after 1820 these alone were made at the rate of 10,000 a year.‡ Other patents were issued in 1816, 1822 and 1825, and until 1837 the wooden clock dominated the market. At this time very few clocks were made outside of Connecticut, and within the State Plymouth was the most important center.§

Efforts were continually being made to secure satisfactory results by the use of metal. Iron and steel were rejected because of rust.|| Some cast brass was used especially for expensive works. About 1825 sheet brass appears, the parts being cut from the metal by machinery.¶ At this time the

*Tench Coxe, "Series of Tables."

†Digest of Mfrs., 1823.

‡This shelf clock was a 30 hour clock, and its cheapness made the cast brass clock an impossibility. Jerome, "History", p. 39. "History of Plymouth", Atwater, pp. 220-221.

§See "Series of Tables", Tench Coxe. Digest of Mfrs., 1823. According to Bishop (Vol. II, p. 377) in 1833, $50,000 worth of wooden clocks were made in Meriden, and (Vol. II, p. 396) in 1835, 100,000 clocks, mostly of wood, were made in Conn. See also U. S. Gov't. report on manufactures, Jan. 19, 1832; and Statistics etc., of certain branches of industry (Conn.), Oct. 1, 1845.

||In 1830 a patent was given J. P. Bakewell of Pittsburg, Pa., for *glass* wheels for clocks! (Bishop, Vol. II, p. 351).

¶"Hist. of Plymouth", Atwater, pp. 219-223. The first sheet brass wheels were cut from old kettles.

wooden clocks were in the main of an eight day model, and the first users of brass thought it necessary to adopt this design. A sheet brass clock could at this time be made and sold for $20. The constant cheapening of the wooden product kept them from a large sale. In 1837, Chauncey Jerome, who had been employed by Terry since 1816, perfected a radical and revolutionary invention as he placed upon the market a one day brass clock, which could be manufactured for $6, and which at the start was sold in competition with $10 or $15 wooden clocks.* The panic of 1837 seriously affected some of the older makers and Jerome's invention was an instant success. In 1842 a consignment of Jerome's clocks was sent to England, which was the beginning of a large and very profitable trade.† The possibility of large profits attracted other makers and the manufacture increased notably. By 1840 a yearly output valued at nearly $1,000,000 was reached. Then competition lowered prices to a disastrous extent. In 1855 Jerome's own company failed and others also. Production decreased for a time, until the panic of 1857 finally cleared the field and the business became established on a permanent basis.

Jerome's invention in 1837 increased greatly and suddenly the demand for sheet brass, and it came at just the time when the brass mills were in a position to meet this demand.

Another household industry which had a notable development, and which also was later in close connection with the

*"Hist. Clock Business", Jerome, pp. 60-64.

†Jerome, "Hist.", pp. 60-64. "Hist. Amer. Mfrs.", Bishop, Vol. II, p. 427. Clocks of an invoice value of $1.50 paid twenty per cent duty and sold freely in England for twenty dollars each. Many thousands were exported. Indeed until 1900 brass clocks were the most important item of export in the whole list of brass manufactures.

brass industry, was the making of pewter and britannia ware. About 1800 there were several small shops engaged in the production of pewter wares. The most important were in Hartford, Meriden and Wallingford.* Pewter was a mixture of tin and lead, in the proportion of four to one.† It fused readily. The process was to cast the metal in the form desired, the articles being then finished by lathe or by hand tools. The first wares were spoons, plates or platters, basins or mugs.‡ The product was marketed by peddlers.

In 1815, Charles Yale, who had been selling tinware in the South, with his brother Hiram, in Wallingford, made a more pretentious venture. They secured skilled workmen with improved processes from England and it is believed that their establishment was the largest in its line in the country. Here britannia was first used, the formula being obtained from the English workmen.§ In this alloy antimony was substituted for part of the lead in pewter. The exact formula was considered a valuable trade secret. The metal was harder than pewter and took a good polish. But the antimony present under some circumstances formed a poisonous compound, hence britannia was not adapted for all purposes. The use of pewter continued. The Yales devoted themselves principally to the making of hollow ware, with a higher finish than had hitherto been secured in this country. The art of electro-plating was first used by James Elkington of London and Birmingham, England,

*"Gazetteer", Pease and Niles, pp. 126, 134. "History of Wallingford and Meriden", C. H. S. Davis, Meriden, 1870, p. 475.

†"Hist. Wallingford", Davis, p. 475. "Mixed Metals", Hiorns, p. 305.

‡"Hist. Wallingford", Davis, p. 475. "A Century of Meriden", Gillespie, Pt. III, p. 38.

§Same as Note above, and "Mixed Metals", Hiorns, p. 313. "The Metallic Alloys", Brannt, pp. 275-281.

in 1837. Shortly after this the art was introduced into this country* and was used by the Yales on their britannia ware with very successful results, the outcome being a largely increased demand.†

Pewter could not be rolled, nor could britannia to advantage. Some rolling was attempted, with unsatisfactory results. While the Yales introduced water power for finishing, the rough goods were still in general made by the old casting process.

In 1836, Robert Wallace, who had been employed by the Yales, secured from an Englishman in New York, for $25, a new formula. This was an alloy of nickel, zinc and copper, in the proportion approximately of two of copper to one of each of the other metals. Wallace secured small amounts of the necessary metals and fused them together.‡ The product was sent to a brass rolling mill in Waterbury and the first rolling of German silver in this country was the result.§ This was found to be harder than britannia, was

*Before this all silver plate and the most of solid silverware had been imported. Some silver ware had been hammered out by hand by local silversmiths. "Hist. Wallingford", Davis, p. 477.

†In 1833 in Meriden, which till 1806 was a part of Wallingford, britannia wares were made to the value of $225,000. See Bishop, "Hist. Amer. Mfrs.", Vol. II, p. 377.

‡"Connecticut Historical Collections", J. W. Barber, 2nd. edition, New Haven, 1837, p. 227. "Hist. Wallingford", Davis, pp. 479-480. "Mixed Metals", Hiorns, p. 314.

§It is in dispute where German silver was first rolled. It is claimed that Reed & Barton, a firm name which survives to-day as that of a large establishment of Taunton, Mass., first used the modern process. It is believed, however, that Wallace secured the better formula. It is apparent that the Taunton and Wallingford men reached nearly the same result at about the same time, and surely independently of each other. "Hist. Wallingford", Davis, pp. 479-480. "Hist. Amer. Mfrs.", Bishop, II, p. 361.

well adapted for rolling, took a high polish, was apparently durable; and was successfully used from the first. The rising brass industry found its possibilities enlarged by the making and rolling of German silver and to this day this has been an important item in the trade.

Other examples of the development of household industry into notable manufacturing enterprises might be cited. The making of combs, hats and boots and shoes would be such. Enough, however, has been given to indicate conditions which obtained in several important instances.

When, then, about 1800, as the economic opportunity open to the residents of the State of Connecticut seemed somewhat less promising, many emigrated to the North and West, these undoubtedly secured the larger immediate returns. But those who remained in the State and who endeavored by their enterprise, ingenuity and energy to enlarge economic opportunity by engaging in various industrial enterprises, contributed most largely to its development and made possible the high rank which the State now occupies as a manufacturing center.

CHAPTER III.

Beginning of the Brass Industry in Waterbury.

Early ventures in brass. Cast buttons. First rolling of brass. Beginning of competition. Improved machinery and processes. Rolling for market. Establishment of the industry. Factory system. Other ventures. The market in 1820. Reasons for the establishment of the industry in Waterbury.

OF THE various household industries to which the residents of Connecticut about the beginning of the nineteenth century devoted their energy and ingenuity, the most notable in its development within the State, judging by its connection with the brass industry of to-day and the position which this now occupies, was the making of metal buttons. For here is to be found the germ from which the making and the manufacture of brass has historically developed.

From the earliest days there had been some casting of brass in the colonies. The first attempt in this line was made by John Winthrop, Jr., at Lynn, Massachusetts, after 1644, at his iron foundry. There and at Philadelphia some brass cannon were cast before the Revolution. For fifty years after 1725 Caspar Wistar, his associates and successors, hammered out stills and kettles of both brass and copper in Philadelphia and cast some brass wares.* The basis of

*Bishop, "Hist. Amer. Mfrs.", Vol. I, pp. 471-476, 487, 494, 573, 574. Twelfth Census of the U. S., Vol. IX, Mfrs., Pt. III, p. 321. For a later enterprise, bell casting about 1800, see "History of New Britain, 1640-1889", D. N. Camp, New Britain, 1889, pp. 268-278.

these enterprises was the casting of the metal and finishing it by hand. Undoubtedly others, silversmiths and watchmakers, made use of some brass in their handiwork, but these efforts were out of connection with the brass industry as it actually developed.*

Before 1750 John Allen had been established as a silversmith and brass worker in Waterbury. He made knee and shoe buckles, repaired watches and sold buttons of rolled brass imported from England. At this time buckles were worth ten shillings or more a pair, and brass buttons two shillings apiece.† Allen died in 1749. In 1754 Joseph Hopkins began the making of buckles and buttons of silver and of other metals.‡ After the Revolution the use of pewter became more general, and the making of pewter buttons was undertaken at several places.§ For example in Attleborough, Massachusetts,|| as well as at Philadelphia, this industry became established before 1800.

In 1790 Henry Grilley, who had learned the process from an Englishman in Boston, associated with his brothers Silas and Samuel, began the making of pewter buttons in Waterbury. At this time this was a household industry. The pewter was cast in a mould with the eye in a solid piece and finished by hand. In 1800 the Grilleys improved the process

*See Hamilton's Report 1791, and Gallatin's Report 1810. Amer. State Papers, 1832, Finance, Vol. I, p. 139, and Vol. II, pp. 426, 429.

†"Town and City of Waterbury", Anderson, Vol. I, p. 371. At this time sheet brass was valued at sixteen shillings a pound, and copper ten shillings a pound.

‡The same, Vol. II, p. 257.

§Dr. Dwight in 1798 found the casting of buttons in Waterbury. "Travels", Vol. II, p. 368. See also "A Century of Meriden", Gillespie, Pt. I, pp. 353, 359.

||Bishop, "Hist. Amer. Mfrs.", Vol. III, p. 108.

by the introduction of an eye of iron wire. Two years later Abel Porter and his brother Levi came to Waterbury from Southington, and associating with the Grilleys under the firm name of Abel Porter and Company the manufacture of buttons from sheet brass was undertaken.* Apparently this was the first use on this continent of the modern method of making brass by the direct fusion of copper and zinc† according to the process invented by James Emerson in England in 1781. This also involved the first rolling of brass in this country.‡

Copper was obtained by the purchase of old stills, kettles, ship sheathing and the like, zinc was added and brass ingots were obtained. All the raw material was imported. The ingots were taken to an iron mill in the town of Litchfield, where they were roughly rolled, and then returned to Waterbury, where they were finished by being run between steel rolls two inches in diameter driven by horse power. The forms were struck by dies from the sheet brass, concave, convex, round or oval; the face was gilded and the product placed upon the market.

There was a brisk demand for such buttons for military and other uniforms. Up to this time they had practically all been imported from England, where, in Birmingham, the

*"Town and City of Waterbury", Anderson, Vol. II, pp. 261-264, 275, 276. "History of Waterbury", Bronson, pp. 411, 560.

†The brass which was used in the country before this had either been imported, or made by the fusion of copper and calamine. See Hamilton's Report.

‡"Hist. Amer. Mfrs.", Bishop, Vol. III, p. 440. "One Hundred Years of American Commerce", Depew, Vol. I, p. 330. It is claimed that one James G. Moffet rolled brass in New York City just before this. The power used was a pair of cattle harnessed to a sweep. The Waterbury venture was probably the earlier.

J. M. L. Scovill

manufacture by the casting process had become established before 1700.* The American product was of good workmanship, but it was found difficult to compete with the imported article in finish and in price.† Many improvements were made. In 1815 nine patents relating to button making were issued to residents of the State.

The selling of the product was of the simplest character, being sold at first from house to house until the tinware peddlers added them to their stock in trade.

Slowly the enterprise became established. In 1806 Levi Porter retired from the business. Two years later a skilled mechanic was secured from Attleborough, where the casting process was still employed. A larger mill was erected and water power took the place of the horses which had been used. The next year Silas Grilley sold out his interest. And in 1811 a new partnership was formed, all of the original proprietors retiring, under the firm name of Leavenworth, Hayden & Scovill. From this has come directly the present corporation, The Scovill Manufacturing Company.‡

For twenty years, as far as is known, this was the only sustained effort to roll brass in the country.§ It was not

*Twelfth Census of the U. S., Vol. IX, Mfrs., Pt. III, p. 321.

†About this time, 1810, plain brass buttons sold as low as 80 cents a gross: when gilded or of finer workmanship, sometimes as high as a dollar a dozen.

‡"History of Waterbury", Anderson, Vol. II, pp. 264, 276. "History of Waterbury", Bronson, p. 560. "Great Industries of the U. S.", pp. 1048-1054.

§The manufacture of cast metal buttons persisted till after 1820. In 1810, according to Tench Coxe, Connecticut produced four-fifths of the metal buttons of the country, both processes being included in the returns. At this time brass casting for other purposes was

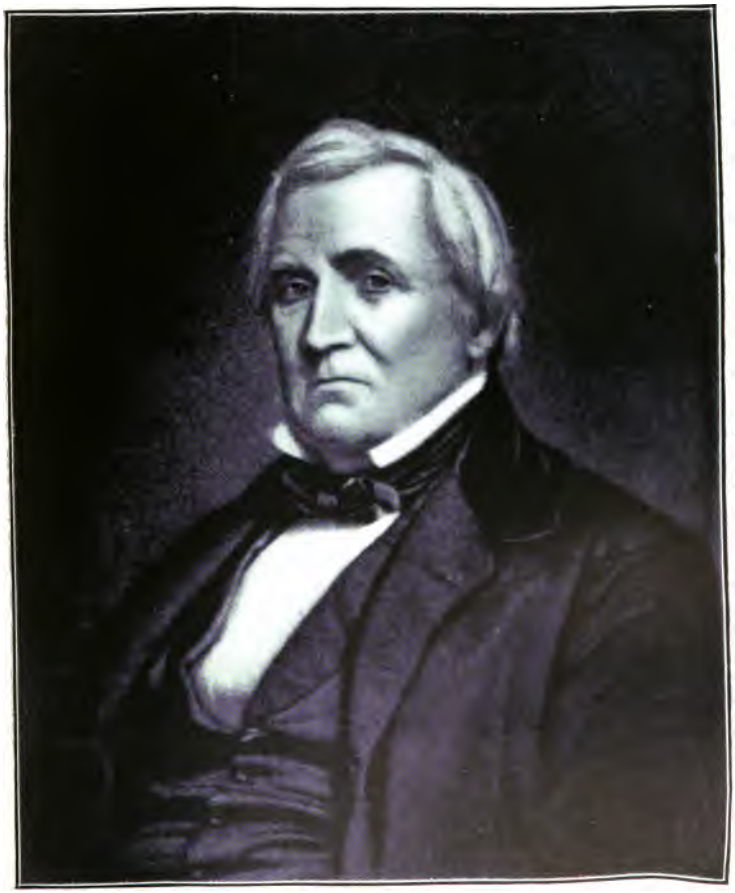
until 1823 that the business had grown to such proportions as to engage attention and to meet competition. In 1812 Aaron Benedict had established himself in the manufacture of bone and ivory buttons in Waterbury. In 1823 he associated himself with four other men, raised a capital of $6,500 and began the making of rolled brass buttons.* From this venture has come the Benedict & Burnham Manufacturing Company, the second of the Waterbury firms to become established in the brass industry.

At first Benedict followed the example of the older firm and had his brass rolled in the iron mill at Litchfield. The larger capital at his command was used to organize the sale of his goods. He placed agents at New York and at Philadelphia. But the effort to extend the market was not successful. It was difficult to compete with the English goods. Before this an attempt had been made to secure skilled workmen from England. There the old casting process had been set aside and rolled brass was made and used. But the English manufacturers endeavored to prevent their workmen from leaving the country, and the first who were secured from there were hardly more efficient than the native Americans. When Benedict found he could not meet the English prices in the open market, his first move was to secure better machinery. In 1824 he secured from England rolls of much the largest capacity then in the country; eleven inches in diameter and thirty inches long.† He tried to economize by rolling his own brass. But still he

also established in the State. Tench Coxe, "Tabular Statement", p. 16. "Travels in N. Y. and N. E.", Dwight, Vol. IV, p. 490.

*"History", Anderson, Vol. II, pp. 296, 297. "History", Bronson, pp. 448, 449. "History of Amer. Mfrs.", Bishop, Vol. III, p. 442.

†Scientific American, May 1, 1880, Vol. 42, pp. 277, 278.



Aaron Bancroft

could not successfully compete with the English makers. The imported buttons had a color which the Americans were entirely unable to imitate. Moreover it was understood that the English manufacturers used six cents worth of gold for gilding a gross, while here three dollars worth was required for the same result. With this handicap slow progress was made.

At the same time the Scovills were endeavoring to better conditions. In 1820 an agent of a firm in Naugatuck was introduced in Philadelphia to one James Croft, who professed to have lately come from England and who claimed to be able to secure the orange tint so much desired by the American manufacturers. He said that he had been in the employ of the firm in Birmingham whose goods had held the highest rank in the American market. This information was given to one of the partners in the Scovill firm. The reply was received that "they had tried English workmen enough." Mr. Croft, however, came to Waterbury and entered the employ of the Scovills. He soon proved that he could accomplish all that he claimed. He declared that the machinery here in use was much inferior to that in England and he was sent thither to secure better. He returned with an expert toolmaker and the product of the firm was vastly improved.

With the heavier machinery of Mr. Benedict and the services of these two skilled men, Mr. Croft and the English mechanic, it was found that English competition could be met and the profits of the manufacture rapidly increased.

It was during this decade, from 1820 to 1830, that the rising industry passed the experimental stage.* By 1830 it

*On April 4, 1827, the firm of J. M. L. & W. H. Scovill succeeded Leavenworth, Hayden & Scovill. W. H. Scovill at this time bought

was securely established and the first move to a larger business was taken. Up to this time the manufacture of buttons alone had been undertaken. In 1824 Benedict began to roll his own brass, and in 1829 Scovill began to roll his. Shortly after this Waterbury rolled brass began to come upon the market. As this extension of the operations of these firms from the simple making of buttons to the rolling of brass for market marks a real crisis in the industry, it will be well to consider the condition of the trade at this time.

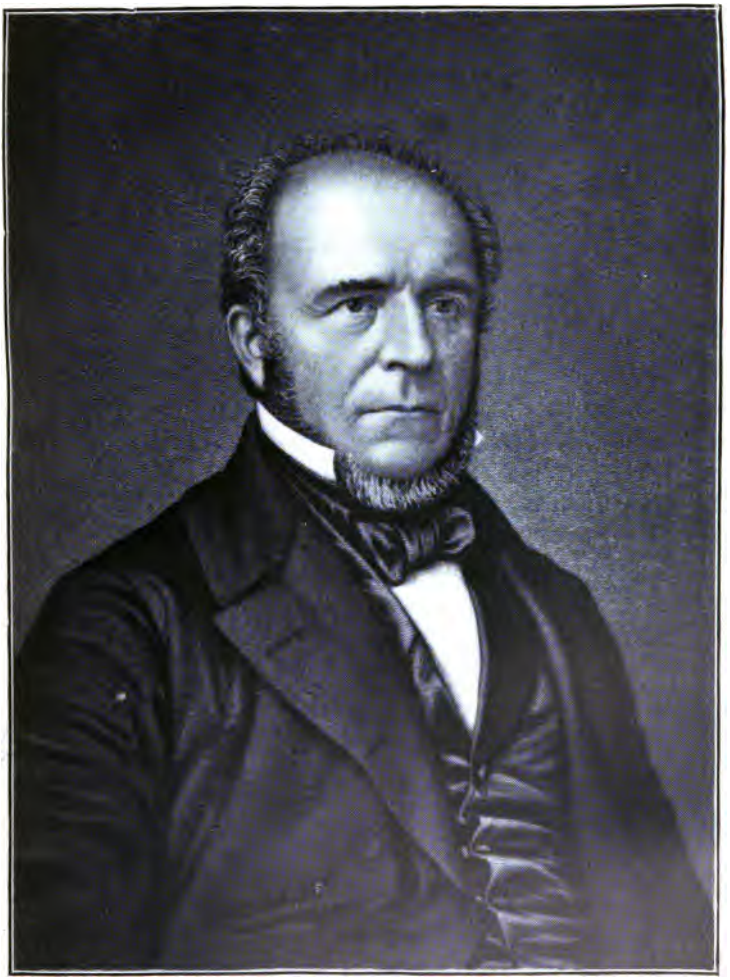
As the manufacture of buttons was at this time carried on in Waterbury it involved the essentials of the factory system.* The old processes involved only the casting of metal into moulds and finishing by hand, and could be and were carried on as a household industry. In Waterbury machines were used which were unique, demanded the attention of operatives and could not be duplicated for household use. In this respect this industry in its organization differed from that of the textiles. This had been on a factory basis both in England and to some extent in this country. But this was but the assembling under a simple organization of an industry which had long been carried on in the household and at the first with no essential change in the machinery used.

In Waterbury the machinery demanded the use of power. Horse power was used at first; water power after 1808.

There was some division of labor; the rolling of the brass,

out his brother's partners and the capital of the new partnership was estimated at $20,000. On Feb. 2, 1829, the partnership of Benedict & Coe was established also with $20,000 capital, succeeding the older firm established in 1823 by A. Benedict with $6,500 capital. "Town and City of Waterbury", Anderson, II, pp. 276, 296.

*"Der Grossbetrieb", Leipzig, 1892, G. von Schulze-Gävernitz. "Evolution of Modern Capitalism", J. A. Hobson, Chap. II-IV.



Wm A Scoville

operating of the dies and stamps which cut out the blanks and the finishing being quite distinct operations.

But it must not be assumed that because the essentials of the factory system were here, the plants were of notable size. In 1820 twenty hands was the maximum number of employees.*

Nor is it to be assumed that in Waterbury were located the only establishments in the country using brass. Sheet copper and brass and wire were imported from England, at least one New York house making a specialty of this trade.† From 1801 the Revere Copper Company in Canton, Massachusetts, has continuously rolled copper.‡ And in 1813 the Soho Copper Company, which has also been in continuous operation to the present time, began to roll copper at Belleville, New Jersey.§ The raw material was at first old ship sheathing, stills, boilers and so forth, which were collected, melted into pigs and then rolled. Some pig metal was imported. Until the middle of the century the only sources of raw material were either old copper which had ultimately

*See Digest of Mfrs. ordered by Congress, March 30, 1822.

†Both Hamilton in 1790 and Gallatin in 1810 declare that all copper was imported. Gallatin reports the Revere Copper Co., which he says is not prosperous, a few brass casting shops and unimportant manufacture of small wares, including buttons.

‡Paul Revere organized this company.

§See for these ventures, Bishop, "Hist. Amer. Mfrs.", Vol. III, pp. 96, 126, 440. Scientific American, Vol. 41, Dec. 13, 1879, p. 380. "One Hundred Years of Amer. Commerce", C. M. Depew, article by A. A. Cowles, "Copper and Brass", Vol. I, p. 333. The Soho Company has been controlled by Hendricks Brothers of New York, a firm which has been in the metal trade for more than one hundred and twenty-five years. At this mill there are to-day the largest rolls for copper in the country and probably in the world, 156 inches long and 30 inches in diameter.

come from abroad, or direct importation of new metal either in sheet or in pig form. All the zinc used for making brass was imported till about 1870.

Rolled copper for the purposes for which it was then used did not require as fine machinery nor as skillful handling as brass. Until after the middle of the century there was no rolling of brass in the country in appreciable amounts except at Waterbury.

The sheet copper imported before 1820 was used in the main for ship sheathing; in smaller amounts copper and brass were used for the making of stills and kettles and in smaller amounts still in the manufacture of firearms and small wares. Some old copper besides that which was rerolled, and some imported pigs, was made into brass, which together with imported brass was used for casting bells, cannon and andirons. The disorganized character of the industry may well be appreciated as it is noted that one establishment in eastern Connecticut reported in 1820 that the casting of andirons was carried on in connection with the making of shirtings.*

The casting of brass has called for no peculiar skill, other than that which may be required for the casting of other metals, and has always been widely carried on. This department of the manufacture has never been centralized in Connecticut in the same degree as the rolling of brass and its manufacture.

In the aggregate, as far as can be determined, about 150

*"Digest of Manufactures", 1823. According to the Report of Sec. of State, 1824, one establishment is returned as located in Taunton, Mass., engaged in the manufacture of copper, iron, wool and cotton!

to 200 tons of copper and brass were used annually in the country in 1820, of which about a sixth was consumed in Connecticut.* The direct importations of new metal would not reach this amount, for the same material would be used in some cases several times over.

The question may be asked why the rolling of brass for the making of buttons was undertaken at Waterbury. This may be considered under three specifications.

I. There was no intrinsic reason why the venture might not here be made. The amount of material which was involved was small. There were old articles of copper, kettles, stills or such, which could be obtained almost anywhere. This was at the start the raw material which was used.

Moreover the weight of the product was not so large as to be a serious item in the matter of transport. A peddler could carry on his back or in the wagons of which mention has been made a considerable supply, with no great inconvenience on account of either the weight or the bulk. The cost of the transportation of a dozen buttons could hardly figure in the selling price. At first the product was marketed by peddlers. The first real crisis in the early history of the enterprise came when after 1823 the attempt was made to meet the English goods in the open market.

Plentiful supplies of wood were needed for the annealing furnaces. A single plant has used in recent years upward of eighteen thousand cords. The available supply of wood is now near the point of exhaustion. Compelled by this fact serious attempts are being made to find some satisfactory substitute. To this end coal and oil are both being used. But at the beginning wood in sufficient amount was easily

*"Digest of Manufactures", 1823.

secured near Waterbury. However, this condition was not peculiar to this single locality.

Power was needed, but at the start the amount required was not large. Water power was used after 1808, and Waterbury is tolerably well supplied with streams which could be used.* But so were many other towns. Indeed the valley of the Housatonic River, but a few miles west of the Naugatuck, contains available sites and a much larger amount of available water power. Even the Naugatuck affords many much better power sites than Waterbury.

II. The reason why the industry was started at Waterbury seems to be that this was the residence of the pioneers. This settlement seems to have been peculiarly confined in its economic possibility. Just here the soil was poor. The few good farms were all occupied. Conditions made it necessary for the rising generation to leave, starve or engage in some other industrial venture. Many left, some remained in poverty, a few laid the foundations of the present brass industry.

Waterbury was the home of the Grilleys who had cast pewter buttons before 1800, of the Porters who with them first used rolled brass, of the Scovills who succeeded them, and of Aaron Benedict and Israel Coe who first entered into competition with them. Indeed of those who before 1830 were at all prominent in the trade there was but one outsider, David Hayden, who in 1808 came to Waterbury from Attleborough, where he had been interested in the making of cast buttons. Mr. Hayden seems to have been the only one of prominence who was before 1830 attracted from a permanent settlement elsewhere to Waterbury because of the existence of the rising industry there.

*The Naugatuck and Mad Rivers afforded sufficient power.

Resp'y Yours Isaac Coe

III. These men working at their homes, under conditions which were not unfavorable, brought to the venture sufficient enterprise and perseverance to continue in the undertaking until they were able to see the need and to command the assistance of English machinery and English skill.

It was this enterprise and continued perseverance which enabled these men in Waterbury finally to overcome English competition and to furnish a home product in response to a home demand. At the start no such outcome could have been predicted. It took a year and a half for the original enterprise to get fairly started. This new venture might easily have gone the way of many another and have died an untimely death. That success was by no means assured at the start is apparent from two facts:

First: Those who started the enterprise after a few years abandoned it to their successors. The original undertakers began to drop out after four years and at the end of nine years none of them were left. It was the second generation which carried the business through to a successful end.

Second: The observations of visitors were almost without exception unfavorable to the inauguration of new manufacturing enterprises. Two quotations will suffice, both by Englishmen.

In 1794 it was remarked by Thomas Cooper that as a result of a six months stay in America it was his opinion that there was some demand for itinerant tradesmen such as silversmiths and watchmakers, that a brass founder, meaning a caster of brass, might find employment, together with iron workers, carpenters and masons; but while "land is so cheap and labor is so dear, it will be too hazardous a speculation to embark a capital in any branch of manufacture which has not hitherto been actually pursued with success in this coun-

try." And he adds in a note, "while America and England are at peace there will be little or no temptation to set up manufactures in the former country."*

And Lord Sheffield in his observations on the commerce of the American states expressed the confidence of the English manufacturers, as he declared that manufactures of iron and steel would be supplied for long by England. Tin plates and copper in sheets to be wrought into kitchen and other utensils "can be had only from Great Britain to any advantage."† As for buttons, the possibility of any venture in such manufacture is disdainfully set aside with the remark that "this will be one of the last manufactures which it will be worth the while of the Americans to attempt."‡

*"Some Information Respecting America", Thos. Cooper, Dublin, 1794, pp. 1, 59.

†"Observations on the Commerce of the American States", John Lord Sheffield, London, 1804, p. 29.

‡The same, p. 25.

CHAPTER IV.

GROWTH AND DEVELOPMENT.

The market in 1832. A new firm. Manufacturing the product of the rolling mills; butts, kettles. Extension of the industry. Beginning in Wolcottville, Derby and Ansonia. Rolling copper. Pins. Photographic plates. New plants. Reasons for the localization and success of the industry; enterprise of the pioneers, labor conditions, the tariff.

DURING the ten years from 1820 to 1830 the two firms engaged in the manufacture of rolled brass buttons became established. In 1820 a liberal estimate of the capital of Leavenworth, Hayden & Scovill would be $5,000. In 1830 each of the two firms then in the business commanded a capital of $20,000, the most of which represented profits. A real beginning had been made. But during this same decade all branches of manufacturing in the country experienced something of the same expansion. We have in hand certain statistics relating to the manufactures of the United States collected in accordance with a resolution adopted in the House of Representatives, January 19, 1832.* While these returns are quite incomplete, yet they are the most satisfactory in those sections where manufacturing was most highly developed. From these returns supplemented by other investigations it appears that since 1820

*Executive Document No. 308, 22nd. Cong., 1st Session, 2 Vols., Washington, 1833. Returns are quite complete for Mass. and Conn. and less so for other States. The reports are only from N. E., N. Y., N. J., Penn. and Del., with some scattering returns from Ohio and other States.

the consumption of brass and copper had more than doubled, being at this time perhaps 500 tons.* It is impossible accurately to separate the copper from the brass, but the amount of brass may have been 50 to 60 tons.

Four-fifths of the copper was used for ship sheathing and for bolts and nails, also in the main used in ship building. More than three-quarters of the remainder was consumed for various castings. The principal products were bells, kettles and andirons. For some of these products the copper was mixed variously with other metals; tin, lead, antimony, nickel and zinc. Of the balance, aggregating not more than twenty tons, the largest demand was for lithographic plates, then came stills, engine parts, tin shops and small hardware.

Brass was widely used, in the main in small quantities. For casting the alloy was usually compounded by the founder. There was a demand in the market for some thirty tons of sheet brass and twenty tons of wire. The sheet metal was used in the making of stills and in tin shops; also for clocks, plated ware, fire engines and some lithographs. Brass wire was used in the manufacture of cards, brushes, cages and machinery. At this time brass kettles in the main were cast; copper kettles were hammered from sheet metal as well as were cast. The more of alloy there was present the greater the difficulty in hammering them into shape. All of the wire and all but about ten per cent. of the sheet metal was imported

Sixty per cent. of the copper was imported in the form in which it was used. Forty per cent. of the raw material was obtained by rolling imported pig copper and by working over old material. There was a refinery for old copper at Taun-

*See pp. 44, 45.

ton, Massachusetts, and the rolling mills already referred to at Canton and at Belleville* were in active operation.

The only record of the use of domestic sheet brass is by certain manufacturers in Boston, who used perhaps three tons of Waterbury brass in the making of kettles, fire engines, grates and fenders and for silver plating.†

This was the demand which the Waterbury men undertook to supply after providing for their own needs. To-day it seems to be a very limited demand, but the brass industry is as it is to-day because the Waterbury men undertook to supply the market and finally succeeded in their undertaking. A confirmation of the result already reached is found in the fact that on one occasion about this time when the navigation of the Housatonic River to Derby was impeded by ice, three four-horse teams were dispatched to New York in order to secure metal to keep the mills in operation.

The price of sheet copper at this time was from seventeen to thirty cents a pound; of sheet brass from sixty to eighty cents; of brass wire from forty to seventy cents. All through this period, down to 1850, the margin of profit was large. The raw material cost for a pound of sheet brass from sixteen to twenty cents, and the labor about eight cents; while the product delivered at the market sold as high as seventy-five cents.

The margin of rolled brass above their own needs which the two existing concerns in Waterbury could put upon the market was small. Believing that a profitable business could be established, in 1830 a new firm was organized, intending to roll metal and to draw wire exclusively for market. Israel

*See p. 43.

†This was rolled plate. Electro-plate did not come in till after 1837.

Holmes, who had been in the employ of the Scovills and who started more new enterprises in the working of brass than any other individual, associated seven other men with himself, raising a capital of $8,000,* and began the manufacture of sheet metal and wire for the market. The first firm title was Holmes & Hotchkiss. The venture was not immediately successful. Within eight years several changes were made in the partnership. In 1838 the name was fixed as Brown & Elton, which was continued until 1856, when the partnership was dissolved.

The prosperity of this new firm was entirely dependent upon machinery and workmen whom Mr. Holmes in 1831 secured from Birmingham, England. He secured three sets of rolls and six wire blocks; and a caster, roller, wire-drawer and tube maker.† This was the first effort to draw wire‡ and to make tubing in this country.

After the advent of this third firm in Waterbury it was possible to produce sheet brass and wire in much larger quantity than the open market could absorb. It was difficult to compete with the imported product. The manufacturers were driven to the task of working up their own product. Up to this time the making of metal buttons had furnished the only local demand for sheet brass. Now, however, was called into active operation the enterprise, which having established in Waterbury the first rolling of brass, determined that the industry should be here localized.

Holmes & Hotchkiss began the making of brazed

*"Town and City of Waterbury", Anderson, Vol. II, pp. 319, 329.

†"Town and City of Waterbury", Anderson, Vol. II, p. 323.

‡A good description of the technique of wire drawing may be found in Scientific American Supplement, Jan. 19, 1907, Vol. 63, p. 25, 950.

Philo Brown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tubing. This was made of sheet metal, brazed at the joint. After 1836 such tubing was used for interior work for gas, first by the New York Gas Company. This firm also attempted to supply the domestic demand for brass wire. At this time twelve or fourteen tons of wire was a six months' supply and it was all imported.* It was not easy to secure the market. However, gradually this was accomplished and in 1835 twenty-five hands were employed in this department alone.† At this time no local competition had developed. In 1836 this new firm began the manufacture of hooks and eyes, the first successful attempt in this country.‡

In 1810 hooks and eyes had cost $1.50 a gross.§ Attracted by the possibility of large profit some attempt had been made to manufacture them of imported wire; but owing to a lack of skill this was shortly abandoned. When Holmes & Hotchkiss found a surplus of wire on their hands they undertook this manufacture, and for some years they were the only ones to use domestic wire for this purpose.|| Shortly after this, in 1842, the company took up the making of pins.

Another new undertaking at this time was the making of brass butts. These had formerly been cast of iron as well as of brass. The manufacture had been established in Troy, New York, before 1830.¶ About 1835, Benedict & Burnham, who in the previous year had succeeded Benedict & Coe, made butts of rolled brass at a cost and with a finish which easily rivalled those made of cast metal. At this time

*"Town and City of Waterbury", Anderson, Vol. II, p. 262.

†The same, Vol. II, p. 243.

‡"History of Waterbury", Bronson, p. 561.

§"History Amer. Mfrs.", Bishop, Vol. II, p. 427.

||In 1845 the only manufacture of hooks and eyes which was returned was in Conn. Sen. Doc. 444, July 23, 1846.

¶"History Amer. Mfrs.", Bishop, Vol. II, p. 349.

there was an active trade in imported butts.* In 1836 the Scovills took up this manufacture and the local market was gained.

At about this time, as has already been noticed, the invention of the rolled brass clock created an active demand for sheet brass.† Also the rolling of German silver was introduced.‡

Two other ventures also were made at about this time, which for different reasons had a large place in the subsequent history of the trade. The result was to add two new plants to the industry.

In 1834 Mr. Israel Coe left his partnership with Mr. Benedict and associated himself with Mr. Anson G. Phelps of New York and Mr. John Hungerford, shortly including Mr. Holmes, who sold out his interest in Holmes & Hotchkiss, and organized a new industry in what was then Wolcottville, now Torrington. Here the making of brass kettles was undertaken, by the battery process, so-called.§ The kettles were hammered into shape from blanks. Before this brass kettles had been cast. At first imported cast blanks were used. Then the attempt was made to cast blanks, then to use sheet brass. But the right mixture of the metal was not discovered, nor was an annealing process which was satisfactory found. The metal cracked badly under the hammers. The hammer was a long wooden beam shod with iron. The noise of the shop was said to have been deafening, the

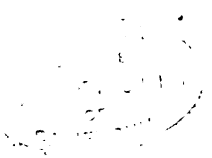
*Bishop, Vol. II, p. 388.

†See page 32.

‡See page 34.

§"History Amer. Mfrs.", Bishop, Vol. II, p. 388. "History of Torrington, Conn.", Orcutt, Albany, N. Y., 1878, pp. 101-104. This new mill also rolled metal for a button factory near by which was started about the same time.

John Hancock



F. V. Hayden

workmen filling their ears with cotton. At first it was thought that the difficulty arising from the cracking of the metal was due to defective skill on the part of the workmen and a number of skilled men were imported from England.* These proved to be but indifferent workmen and still the product was not satisfactory. The new concern but barely weathered the financial storm of 1837. In 1842 Mr. Coe visited the only two establishments in Europe using this process† and secured the right mixture and the proper annealing process. Immediately the product was vastly improved and for several years the concern was very prosperous.

In 1851 Mr. H. W. Hayden, then in the employ of the Scovills, invented the process still in use of forming kettles by spinning and turning‡ and the Wolcottville concern found its business practically gone. Before this time his associates had one by one become interested in other enterprises and the control of the plant had passed to Mr. Hungerford. Later the workmen were hired away by another concern in Ansonia. In 1863, after being practically idle for several years, the mills were sold and the men who organized the Coe Brass Company took charge of the plant and achieved large success in drawing wire and the rolling of German silver, brass and copper.

The other venture had an even larger effect upon present conditions. It marks the introduction of a new factor in

*"Town and City of Waterbury", Anderson, Vol. II, p. 324. See page 90.

†Anderson, Vol. II, p. 302.

‡In this process a blank of metal is securely fastened to a die, which is then made to rotate. A tool is then pressed against the metal, which is thus shaped to the die. The patent was dated Dec. 16, 1851.

the industry. Up to this time each new departure had been taken by those already identified with the existing mills. Mr. Anson G. Phelps was an importer of tin, brass and copper in New York, and hence was in closer touch with the domestic market than the Waterbury men. In 1834 he had become interested in the Wolcottville venture and in 1836 he, associated with some other men, built a mill for the rolling of copper at Derby.*

Derby was an old settlement on the east bank of the Naugatuck River where it joins the Housatonic. Before 1812 it had been the port of entry for the lower Naugatuck Valley and it had enjoyed a profitable shipping trade. It lies at the head of the navigation of the Housatonic, seventeen miles below Waterbury.

Mr. Phelps had made a large fortune in the import trade and had considerable capital at his command. He felt that he could successfully compete with the mills up the Valley. Smith & Phelps, as the partnership was called, located their plant on the west bank of the Naugatuck; calling the new settlement Birmingham, after the famous English center. The panic of 1837 broke just as the enterprise was getting started, but from the first the new plant was successful. Workmen and machinery were secured from England and men were hired in Wolcottville and Waterbury. The new mill made a specialty of copper sheets and wire and this manufacture was largely drawn hither. In 1838 the mill was burnt, being immediately rebuilt.

Mr. Phelps, encouraged by the success of his venture, thought to organize a large manufacturing community at Birmingham and to this end sought to secure control of the

*"History of the Old Town of Derby", Orcutt and Beardsley, pp. 349, 414-416.

Anson G. Phelps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surrounding land. This project was arrested, as a man, learning of the plan, bought a farm which was considered essential to its accomplishment and raised the price of it from $5,000 to $30,000. This Mr. Phelps refused to pay and went two miles up the river where he founded Ansonia, which was so called from Mr. Phelps' given name.* In 1844 a rolling mill was here constructed. Later, as the Wolcottville Brass Company lost its command of the market for brass kettles, Mr. Phelps secured the most of its skilled labor, and in 1854 the Derby mill was abandoned and the Ansonia Brass and Copper Company was organized,† which has come to be one of the largest establishments in the trade.

The success of Mr. Phelps' venture definitely added the handling of copper to the already established brass business.‡ His enterprise also added a new branch of manufacture to the rising industry, namely, the making of pins from brass wire.

The story of pins is one which well illustrates the progress of the nineteenth century and the ingenuity of the American inventor. From the thorn of the thicket and the wooden skewer to the modern pin of iron or of brass wire is a long step. The Romans used hand made pins of bronze, of

*"History of the Old Town of Derby", Orcutt and Beardsley, pp. 416-417.

†This company was efficiently managed from the first. It had sufficient capital at its command. Mr. George P. Cowles was the resident executive head. He had been in the employ of the Wolcottville Brass Co. Mr. Phelps induced him to come to Ansonia in 1848. From 1869 to his death in 1887 he was Vice-President of the company. His enterprise and ability was a large factor in the development of the company.

‡"Connecticut Historical Collections", J. W. Barber, 2nd. edition, 1837, p. 198.

which some have been found. The first brass pins of England of record were imported from France in the days of Henry VIII.* Shortly thereafter the manufacture of pins was undertaken in England. The greatest advance which was made until 1800 was in the perfection of a wire wound head. This sometimes worked loose, to the injury of the user's fingers. Adam Smith in his "Wealth of Nations"† illustrates from this manufacture the advantage of the division of labor. At this time the head was made separately and the making of the pin required eighteen separate operations. Ten persons could make 48,000 pins a day.‡ After 1800 various improvements were made and a solid headed pin was perfected in England.

In this country in the colonial days pins were imported and were very costly. One of the items in the inventory of an estate filed in Waterbury in 1749, in company with wearing apparel, breeches, coats, knives and a razor, is a "paper of pinns."§ In 1775 the provincial assembly of North Carolina offered a bounty of £50 for the first twenty-five dozen pins of domestic manufacture equal to those imported from England.|| At this time pins cost seven shillings, sixpence a dozen. After 1812 pins sold at a dollar a package.¶

*The cost of pins and their usefulness gave form and meaning to the phrase "pin money", designating the sum allowed a wife by her husband for the purchase of these necessary articles.

†"Wealth of Nations", Book I, Chap. I.

‡William Cowper (died 1800) in a short poem entitled "An Enigma", and beginning "A needle, small as small can be", tells of the making of a pin. At that time seven workmen united in the manufacture of the product, and the head was made separately.

§"Town and City of Waterbury", Anderson, Vol. I, p. 371.

||"The Great Industries of the United States", p. 1287.

¶"History Amer. Mfrs.", Bishop, Vol. III, p. 184. 12th Census of U. S., 1900, Mfrs. Pt. IV, Vol. X, pp. 427-429.

About this time an unsuccessful attempt was made to make pins here.* Various other efforts to introduce this manufacture into this country were made, but until after 1830 all pins were imported.

In 1831 Dr. J. I. Howe of New York invented a pin-making machine which was successfully operated.† He made improvements in 1832, 1833, 1838 and in 1841. In this last year the solid headed pin was perfected. The earlier machines had used the wire wound head.‡ At the same time other inventors were at work and two other ventures proved to be successful. By 1840 Slocum & Jillson in Poughkeepsie, New York, and the Fowler Brothers in Northford, Connecticut, were making pins for the market. The Fowler machine proved to be in some respects superior to the Howe machine.

The next improvement was the machine for sticking the pins on paper. The high labor cost made improvement necessary. Slocum & Jillson and Dr. Howe together perfected a sticking machine.§ This gave these makers a distinct advantage over the Fowlers, notwithstanding their better machine for making the pins.

In 1838 the Howe Manufacturing Company, which had been organized in New York in 1835, was located in Derby, under the influence of Mr. Phelps.|| This company con-

*Twelfth Census of U. S., 1900, Mfrs. Pt. II, Vol. VIII, p. 79.

†A story of the life and work of Dr. Howe is given in "Hist. Amer. Mfrs.", Vol. II, pp. 563-566. See also for several items, "Report of Commissioner of Patents for the year 1850", House Ex. Doc. No. 32, Thirty-first Congress, Second Session, pp. 412-414.

‡"History Amer. Mfrs.", Bishop, Vol. II, p. 395.

§"History Amer. Mfrs.", Bishop, Vol. II, p. 478.

||"History of the Old Town of Derby", Orcutt and Beardsley, p. 366. "History of New Haven County", Rockey, Vol. II, p. 393. "History Amer. Mfrs.", Bishop, Vol. II, p. 415.

tinued in business in Derby until 1908, when the plant and good-will were purchased by the Plume & Atwood Company of Waterbury.

At about this same time the enterprise of the Waterbury men appeared in this connection.* In 1842 Brown & Elton purchased the business of the Fowlers at Northford and moved the machinery to Waterbury. They also bought a third interest in Slocum & Jillson and made an arrangement with Dr. Howe for the use of his patent in connection with the sticking machine and began the making of pins. In 1846 Brown & Elton with Benedict & Burnham organized the American Pin Company, bought the rest of the business of Slocum & Jillson and removed the machinery to Waterbury. This gave the control of the effective pin-making machines and the sticking device to the American Pin Company and the Howe Manufacturing Company.

It was the sticking device which was the deciding factor in the control of the American market. In England pins were still stuck upon the papers for market by hand.

Induced by the large profit which was secured by the earlier manufacturers many others attempted the making of pins, but in a few years these had all disappeared. In 1848 there were only two companies in existence, the Howe Manufacturing Company and the American Pin Company. As long as their patent rights continued these controlled the American market.

It is impossible to give from the census returns the measure of the control of this manufacture which still abides in Connecticut, for since 1860 the manufacture of pins and needles

*"Town and City of Waterbury", Anderson, Vol. II, pp. 320, 366-368. "History Amer. Mfrs.", Bishop, Vol. II, p. 439.

is given under one head, notwithstanding the fact that they are made of different materials and by different processes and in many cases by different firms. In 1845 and in 1850 the only returns for the making of pins are from Connecticut. In 1860 75% of all pins as returned are from this State.* And according to the latest returns 64% of the national product of needles and pins is also from Connecticut.

The three establishments in Waterbury, the Scovills, Benedict & Burnham and Brown & Elton, with the Wolcottville concern and the Derby mill, were the only ventures in the brass industry before 1840. It is believed that at this time they were the only establishments in the country devoted to the mixing and the working of sheet brass.

The panic of 1837 broke just as the three newer concerns were getting started, and had it not been for the large profits secured in the industry it would have been impossible for them to have continued in operation. The increased demand, due largely to Mr. Jerome's clock and the control of the business, led to rapid recovery when once the crisis had been passed. After 1840 a season of large prosperity was entered upon. The demand broadened considerably. The manufacturing ventures were increasingly successful and the next decade was relatively the most prosperous of any until 1880.

Shortly after 1840 another industry calling for the product of the brass mills came into being and this also was undertaken by the mills themselves in the effort to work up their product. The invention of Daguerre in the realm of photography in 1839 was at first applied to silver plates.

*See Senate Doc. 444, July 23, 1846, and census returns for dates as given.

Soon, however, it was found that copper plated with silver* answered the purpose and in 1842 the Scovill Company undertook to supply this demand.† From the first the venture was successful. Plates considered better than the English and nearly as good as the French were placed in large quantities upon the market. Other manufacturers followed this example‡ and for many years the making of photographic plates was an important item in the trade. Many other uses were found for copper and brass in the business of the photograph galleries and the brass mills made it their business to supply the demand.

The expanding trade and the large profits secured encouraged competition and during the next few years several new plants were located.

The first new concern to roll brass was the Waterbury Brass Company.§ The first step in the organization of this company was taken by a man who owned a mill privilege on the Mad River. He enlisted the interest of capitalists, including Mr. Elton of Brown & Elton; and Mr. Holmes was induced to sever his connection with the Wolcottville company and to assume the presidency of the new concern. In 1846 the first mill was built, the largest at that date in the country. In 1852 this company bought of Mr. Hayden his newly invented spinning process and proceeded to command the manufacture of brass kettles in the country. The success of the new company as well as its rapid growth is

*The first copper-silver photographic plates were of rolled plate. A thin sheet of silver was fused to a copper ingot, and rolled down together. Later the silver was applied by the electro-plating process.

†"Town and City of Waterbury", Anderson, Vol. II, p. 277. "History Amer. Mfrs.", Bishop, Vol. III, p. 441.

‡See page 65.

§"Town and City of Waterbury", Anderson, Vol. II, pp. 332, 333,

John P. Elton

Thos Wallace

indicated by the increase of its capital stock. At the beginning this was $40,000, increased the same year to $50,000; in 1848 this was $75,000; in 1850, $104,000; in 1852, $208,000; in 1853, $250,000; in 1857, $300,000; and in 1860, $400,000. From 1855 to 1860 this concern handled the largest weight of metal of any in the Valley.

From Mr. Phelps' venture in Derby two other companies arose. The first was in 1848 in Ansonia. Thomas Wallace, who had learned the trade of drawing wire in England, in 1832 removed to America.* For nine years he worked with uncertain results at his trade in various places. In 1841 he removed to Derby† and until 1848 he drew wire for the pin machines for the Howe Manufacturing Company. In that year he began operations on his own account in Ansonia, and in company with his sons built up a large business in rolling metal and drawing wire. In 1853 the enterprise was incorporated and a good business was done. After 1880 this plant was one of the largest in the Valley. Later the company was forced into liquidation and in 1896 the plant was bought by the Coe Brass Company.

The second outgrowth of Mr. Phelps' activity appeared in the organization of the Humphreysville Copper Company in Seymour, in 1849,‡ with a capital of $40,000, increased to $200,000 in 1852. The moving spirit in this company was Mr. Thomas James, who had been first in the Derby mill, moving to Ansonia in 1847. In the earlier years this new

*"History New Haven County", J. L. Rockey, Vol. II, p. 485.

†"History of the Old Town of Derby", Orcutt and Beardsley, p. 664.

‡"History of the Old Town of Derby", p. 482. Connecticut Quarterly, Vol. 6, 1900, pp. 320, 321. "Seymour and Vicinity", Sharpe, pp. 83, 87.

company was very prosperous. But in 1855, with a nominal capital of $750,000, it was succeeded by the New Haven Copper Company with a capital of $400,000. The new company was still over-capitalized and for nearly twenty years financial difficulties interfered with the prosperity of the concern. Since 1880 the company has been moderately successful. From the first it has made a specialty of handling copper.

Again in 1851 a new firm was organized in Waterbury which claims to be the first to use steam power exclusively for the rolling of brass.* Up to this time the Waterbury Brass Company had used auxiliary steam power more extensively than any of the other concerns. Mr. Philo Brown had been one of the original partners in Holmes & Hotchkiss and was a member of the firm of Brown & Elton, which had in 1838 succeeded the earlier partnership. In 1851 he associated others with himself and the partnership of Brown & Brothers was organized. In 1856 this new firm bought half of the business of Brown & Elton, the other half being purchased by Holmes, Booth & Haydens. For thirty years the new firm secured large profit in the rolling of brass and in its manufacture. After 1880 financial difficulties were encountered and in 1886 the company ceased operations. At that time part of the plant was purchased by Randolph & Clowes, then organized. This new firm was at first largely engaged in the making of brazed and seamless tubing. Being large consumers of sheet metal, after three years they established a rolling mill, purchasing at that time the rest of the old plant of Brown & Brothers. At the first the new company was largely successful, but in later years it has been less ably managed and hence less profitable.

*"Town and City of Waterbury", Anderson, Vol. II, p. 343.

Wm Brown

James Brown

The indomitable Mr. Israel Holmes, who had in 1845 assumed the presidency of the Waterbury Brass Company and had carried it to large success, in 1853 severed his connection with that company and organized a new concern, the Holmes, Booth & Haydens.* In 1856 this firm bought half of the business of Brown & Elton. From the first it has been markedly successful and now controls one of the largest plants in the trade. This was the first company which on a large scale started out with a deliberate policy to manufacture its own product. The first concerns had begun as makers of brass buttons, and the rolling of brass had developed under their hand. Holmes & Hotchkiss began to roll brass for market. The Derby mill was organized to roll copper. The Wolcottville concern had been at the first interested mainly in kettles. The other concerns had been organized with some specific object in view. Some of these had been driven to manufacture, as they had facilities for producing more raw material than the open market could absorb. But Holmes, Booth & Haydens was organized to roll metal and then to manufacture it on a large scale. Mr. Holmes had charge of the rolling mill. Mr. H. W. Hayden, the inventor of the spinning process and who had demonstrated his mechanical skill, was put in charge of the maufacture of goods. Mr. H. H. Hayden had charge of the marketing of the product. One who had been in the employ of Daguerre was secured from France and the new company engaged largely and successfully in the making of photographic plates. Also the company engaged from the first in the manufacture of lamps and burners designed for the use of kerosene oil.

The first brass lamp made in Waterbury designed to use

*"Town and City of Waterbury", Anderson, Vol. II, pp. 352-353.

whale oil of which there is a record was made by hand in 1807.* Lamps were made after this date both hammered and cast. Mr. G. W. Burnham, who in 1834 became one of the members of the new firm Benedict & Burnham, succeeding Benedict & Coe, had included brass lamps as an article of trade in his occupation as a peddler of tinware. But the demand was not large. After 1855 petroleum began to be refined and to come on to the market. By 1860 it was generally known and rapidly came into general use. This created the demand for lamps, which in turn was quickly felt by the Waterbury men. Mr. H. W. Hayden of the firm of Holmes, Booth & Haydens, and Mr. Lewis J. Atwood, who was for fifteen years in their employ and who later, in 1869, was active in the formation of a new company, were the two men who led all others in the attempt to adapt sheet brass to the making of lamps and their fittings. A very large business was established in this line.

About this time a new company was organzed in Ansonia as an outgrowth of an earlier venture. The Osborn & Cheeseman Company in 1866 constructed a plant for rolling brass and drawing wire which for a time was quite prosperous.† This was an outgrowth of a manufacture of hoop skirts which had been started at Birmingham in 1858 and removed to Ansonia in 1859. In 1880 the concern employed 250 hands. In 1891 the company went into the hands of a receiver. At this time it was engaged in several lines of manufacture. The rolling mill and a portion of the brass manufacture had been located in Shelton. This plant was sold to the Birmingham Brass Company, organized in 1892.

*"Town and City of Waterbury", Anderson, Vol. II, p. 265.

†"History of the Old Town of Derby", Orcutt and Beardsley, pp. 420-421.

After a somewhat unsatisfactory career, in 1903 the plant and business was sold to the Coe Brass Company, which dismantled the mill and transferred the business to its Ansonia plant.

In this connection the organization of one more concern may be mentioned, the last of the important corporations in the trade. In 1869 Mr. Holmes left Holmes, Booth & Haydens and in company with others organized Holmes, Booth & Atwood, a name which was abandoned by order of the court on account of its resemblance to the older association, and became in 1871 Plume & Atwood.* This new firm bought a brass mill in Thomaston, which had been originally organized in 1854 to roll metal for the making of clocks, and also a smaller concern in Waterbury, and became one of the important factors in the trade.

Mr. Holmes died in 1874. His own personality had bulked large in the story of the brass industry up to that time.† Originally in the employ of the Scovills he had been instrumental in the organization of the Wolcottville Brass Company, the Waterbury Brass Company, Holmes, Booth & Haydens, and Plume & Atwood, which in 1884 with the Scovills produced more than half the gross weight of tubing, wire and sheet metal in the Naugatuck Valley. And at this time the Naugatuck Valley produced more than 85% of the rolled brass and brassware of the country.

The question may again arise why this industry became thus localized in the Naugatuck Valley. During the period

*"Town and City of Waterbury", Anderson, Vol. II, p. 361.

†Since the death of Mr. Holmes, until 1900, not a single concern of first rate importance has been organized in the Naugatuck Valley. Randolph and Clowes, in 1886, was only an apparent exception, for this took over an older plant. See p. 64.

from 1830 to 1860 the amount of material to be handled came to be very large. Freight charges came to be a large item in the business. The rolling mills early found that they could produce more sheets and wire than the market could absorb. And yet the industry remained and increased extensively.

Apparently the success of the enterprise was due in the main to two factors, one of which was dependent upon the other. The factor of prime consequence was the energy and initiative of the men whose fortunes depended upon success. They became convinced that it might become a profitable undertaking. This assurance was based to a considerable extent upon the advice of Mr. Croft, who had been in touch with the industry in Birmingham, England, and who assured his associates that the business was one of the most profitable in which his English friends were engaged. As the work continued this hope of large profit was confirmed by experience. It is a notable fact that of the ten firms to enter the business before 1865 only two were compelled to undergo liquidation. Possibly a third should be included, for the Wolcottville Brass Company suspended operations for a time after the new process for making brass kettles was invented in 1851, but the plant was later reorganized and became conspicuously successful. The two which failed were Brown & Brothers in 1886 and Wallace & Sons in 1895. The expectation of financial profit was well founded and was magnificently realized. Led by this hope the men who were in touch with the rising industry brought to the undertaking splendid enterprise and energy. Difficulties which would have discouraged ordinary men were met and surmounted. Numerous trips were made to England and even to the Continent to secure processes, machin-

ery and workmen. Moreover when a surplus of metal was at hand, the undertakers devised many new processes and invented new applications of brass to marketable wares.

The second important factor in the localization of the industry may be found in the fact that at this time the only labor skilled in the making and the manufacture of brass was to be found in the Naugatuck Valley. On several occasions new processes were established by imported labor and only a few men were competent to do the work. An illustration of this monopoly of skill and ingenuity is seen in the fact that except the first two firms, Scovills and Benedict before 1830, every other new undertaking in the Valley was inaugurated by men who had gained experience in mills already existing.

It is undoubtedly true that the brass men themselves believed that another factor was essential to their success, namely, the tariff. To the extent in which this opinion influenced their conduct the tariff was of assistance.* It is also clear that the tariff did make it possible to maintain prices on a level which otherwise would have been impossible, and to that extent it did increase profits and hence extend a larger inducement to undertake the manufacture.

Brasswares figured in the earliest tariffs. In 1791 the duty on brasswares was 5%; on tin, pewter and copper, 7½%. Hamilton in his "Report on Manufactures" urged that the rates on manufactured brasswares should be raised to at least 7½% ad valorem, and 10% would be still better.† He also urged that copper and brass in sheets, with pig cop-

*The psychological effect and value of the tariff has not often been realized and appreciated.

†"Report on Manufactures", Hamilton, Amer. State Papers, Finance, Vol. I, p. 139.

per and calamine, still used in the making of brass, should be free. By the act of June 7, 1794, the rate on all brass, copper and tinwares was made 15%, which was near the highest rate levied.*

The "embargo" and "non-intercourse acts" of 1807 and 1809, with the War of 1812, largely cut off foreign trade and moreover precede the birth of the industry. The tariff of 1816 fixed the rate at 20% ad valorem, which was the maximum rate at that time, on all brass, copper, pewter, lead and tinwares, brass wire, pins, buttons and moulds.† The act of June 30, 1818, increased this rate to 25%.‡ Many of those interested in various industries urged higher duties from time to time and new tariffs were ordered in 1820, 1824 and 1828. But in none of these was any change made in the brass schedules.§

According to the principle which lay at the base of the tariff of 1833 unmanufactured articles were to be admitted free of duty. The Secretary of the Treasury ruled that sheet brass and wire were unmanufactured articles and hence were to be admitted free. This decision alarmed and aroused the Waterbury men and their action is a good illustration of the alertness and energy which appears in all the early history of the industry. Mr. Israel Holmes, of Brown & Hotchkiss, later Brown & Elton, and Mr. Israel Coe, of Benedict & Coe, were sent to Washington to secure a reversal of this decision. The Connecticut representatives were interviewed and Mr. Clay, the author of the bill, was

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*"History Amer. Mfrs.", Bishop, Vol. II, p. 54.
†Bishop, Vol. II, p. 228.
‡Bishop, Vol. II, p. 242.
§Bishop, Vol. II, pp. 256-259., 291-293, 322-324.

seen. It was determined that no change in the original bill could be made, but a special bill was introduced ordering the Secretary of the Treasury to include sheet brass and wire in the list of manufactured articles. This bill was passed March 2, 1833, in almost the last hours of the expiring Congress.* The effect of the bill was to maintain the 25% rate established in 1818.

The bills of 1842 and 1846 made the rate with one or two specified exceptions 30% ad valorem. Clocks, kettles, britannia ware, plated ware, German silver, hooks and eyes and all manufactures of copper, brass and tin were included under the same rate. In 1857, 24%, which was the maximum protective rate in the bill, was levied on all manufactures of the metals already named. In the act of July 14, 1862, the standard rate for the brass and copper schedule was 35% ad valorem. This remained without change till 1883. In the tariff act of that year 45% ad valorem was levied on all manufactures or wares composed wholly or in part of copper, zinc, pewter and other metals not otherwise enumerated, wholly or partly manufactured. From 1894 to 1897, 35% was the rate adopted for this schedule. With the exception of those three years the rate fixed in 1883 has remained without change to the present.

Ingot and old copper were free until 1846, when a rate of 5% ad valorem was ordered. After 1850 the domestic production of copper became notable. After 1860 exporting began. Those who were interested in the mining of copper, however, seem to have feared foreign competition, for they secured the passage of a special act, Feb. 24, 1869, relating to this metal. By this act, copper ore was taxed three cents

*Bishop, Vol. II, p. 375. "Town and City of Waterbury", Anderson, Vol. II, p. 323.

for each pound of fine copper therein, old copper was assessed four cents a pound, pig and bar copper five cents a pound and sheet copper with all manufactures of the metal 45% ad valorem. For pig copper the rate was about 25% ad valorem. Later these rates were reduced to half a cent a pound for fine copper in ore, a cent a pound for old copper and a cent and a quarter for pig copper.

In a discussion of the effect of the tariff upon the brass industry two facts immediately appear. First; those who were actively engaged in the industry from 1830 to the present time, without a single notable exception, have believed that the tariff was an important factor in the growth and development of the industry. It is certain that many of those who engaged in the industry were encouraged to do so by a belief that the tariff afforded them some protection from foreign competition. In this belief they ventured capital in this enterprise which otherwise might have been devoted to some other manufacture. Second; this industry was singularly favored in the tariff schedules. With raw material free during all of the early period and with never a heavy tax upon it until the industry was practically independent of foreign supply, together with the enjoyment generally of the highest protective rate in force upon the product of the mills, the industry should indicate results most favorable for the protective policy. Such results appear. It is quite clear, however, that the tariff was not the only factor in the case.

If the tariff had been the only important factor to be considered, the industry should have been more widely diffused. The more important reasons why domestic competition did not become acute are probably the advantage of an early start, the practical control of the supply of skilled labor and

the comparatively limited market. For from 1830 to the present day the rolling mills existing at any one time have generally been able to turn out more sheets and wire than could be readily handled in remanufacture. It is impossible to say whether the industry would have become established without the tariff, for this was an existing fact. The value of the tariff has been different at different times. To-day the industry would undoubtedly thrive even if considerable reduction were made in existing rates.

It is probable that the tariff now in force on ore and pig copper is entirely without effect. And probably at no time has this been a matter of consequence to the brass industry specifically. To-day, apart from speculation, the price of raw copper is fixed by the mines of the United States. In Montana, and especially in Arizona and vicinity, large masses of ore of varying richness are available. With the rise of every cent a pound above twelve cents the amount of ore which can be profitably worked increases rapidly. So production increases rapidly with the rise in price, which acts as a balance upon the market.

It is quite certain that before 1830 the tariff was of no large consequence. English buttons undersold American buttons because of superior processes of manufacture. After 1830 for a few years the rolling mills were reaching after the American market. They were only just getting established. The tariff at that time was probably a more important factor than at any date before 1860. From 1837 to 1857 was the period which before 1890 was the time of growth and development. And during these years it is quite certain that American inventive genius, notably in connection with the manufacture of the brass clock, of pins, of kettles and of burners for kerosene oil, was a far more important

factor than the tariff. During this period the industry would have prospered, although it is quite certain that profits were larger than they would have been had there been no tariff. The period of greatest strain was from 1870 to 1885. At times during these years the importation of foreign goods was relatively very large notwithstanding the high tariff rate. It was in order to check this trade still more if possible that the higher rate was urged in 1883. Notwithstanding the increase, the importation of foreign brass and copper wares was at the highest figures at about this time. The periods of largest importations were from 1870 to 1874 and from 1880 to 1886. It is quite certain that at these times and generally from 1870 to 1885 the tariff was an important factor in checking foreign competition. After 1885 the expanding demand, especially in connection with the development of electricity, enabled the Connecticut mills to perfect their organization and to gain control of the market. To-day the price of brass in sheets and wire is usually on a parity with prices in England, notwithstanding the higher scale of wages and the usual higher price of zinc in the United States. The existing tariff at least in its present rates is not an important factor in the trade.

However, the brass industry is a part of the industrial organization of the country and has very intimate relations with many branches of manufacture. If it be granted that the general industrial organization of the nation is based upon a high protective tariff, with its known effect upon wages and prices, it is quite probable that the tariff can not be entirely removed from the products of the brass mills alone without some relatively injurious effect.

CHAPTER V.

The Market.

Salesmen and agencies. Sources of raw material; copper, zinc. Roads and railroads.

BEFORE 1825 the question of the supply of raw material was not acute. The amount needed was small. Old stills and broken kettles were to be found in sufficient quantity.* The zinc needed was imported.

At the first the finished product was handled by peddlers, and for many years various manufactures of brass, such as buttons, kettles, clocks and lamps, could be found in their wagons. Shortly, however, the business outgrew this limited service. About 1820 Israel Holmes began his connection with the industry, when he entered the employ of Leavenworth, Hayden & Scovill, which in 1827 became J. M. L. & W. H. Scovill. Holmes had had experience as a salesman in the South and was at first in charge of the company's store in Waterbury.† When the Scovill brothers organized their first partnership, one of them took charge of the factory in Waterbury and the other handled the sale of goods in New York, Philadelphia, Baltimore and Boston.‡

The later enterprises included salesmen in the organization. From near the beginning of his interest in the metal button business, in 1823, Aaron Benedict had as one of his associates Mr. Benjamin DeForest, who resided in New

*"Town and City of Waterbury", Anderson, Vol. II, p. 275.
†Anderson, Vol. II, p. 321.
‡Anderson, Vol. II, p. 280.

York and superintended the sale of buttons.* And later when in 1829 Mr. Israel Coe entered the new firm of Benedict & Coe, it was as a recognition of his ability proved by three years' experience as a salesman.† And when in 1834 Mr. Coe retired and Mr. G. W. Burnham, who had been a wagon peddler in his earlier days, became the principal member of a new combination with Mr. Benedict, his highest recommendation was that he was an exceptionally efficient salesman.‡ After 1835 he resided continuously in New York in charge of the agency there.

No sooner had Mr. Holmes left the employ of the Scovills in 1830 and organized the new firm of Holmes & Hotchkiss than he took for his part of the business the placing of the product and sought a market in Boston and elsewhere.§

Selling agencies were successively inaugurated as they were needed and pushed the sale of the products of the mills and factories.

With the expansion of the market the demand for raw material became more insistent. Copper and zinc were imported in the form of pigs. Mr. A. G. Phelps, who later organized Phelps, Dodge & Company, was the most important factor in this trade and amassed a fortune in it. From the beginning of this larger demand efforts were made to become independent of foreign supply. In 1837, as already noted, and again in 1857, copper was unsuccessfully sought in the Simsbury mines.|| The ore was rich enough, but it was refractory and expensive to work. No relief was experienced until copper began to arrive from Lake Superior.

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*Anderson, Vol. II, p. 296.
†Anderson, Vol. II, p. 302.
‡Anderson, Vol. II, pp. 303, 304.
§Anderson, Vol. II, p. 262.
||"Newgate of Connecticut", Phelps, p. 24. See pp. 20, 21.

Gordon W. Burnham

Deposits of copper along the southern shore of Lake Superior were known to exist before 1800.* There is no record that they were systematically worked until just before 1850. Between 1845 and 1850 men who shortly interested Boston capitalists began to exploit these deposits and small shipments of copper were made. The copper exists in threads and flakes imbedded in rock. The rock was roasted, the copper separated and sent to market. The metal was originally nearly pure, but the result of the roasting process was that impurities became associated with the metal, and moreover the copper was not in a form to be used in manufacturing.

These facts appearing, Mr. John R. Grout in 1849 interviewed Mr. Israel Coe of the Wolcottville Brass Company, who was in Detroit at the time, and later came to Waterbury and interested Mr. J. M. L. Scovill and others in a smelting project. A party of Waterbury men visited the section and on May 25, 1850, the Waterbury and Detroit Copper Company was organized, controlled by Waterbury capital. The first smelter to handle Lake Superior copper was erected by this concern. In 1867 another smelter which had meanwhile been erected at Portage Lake was purchased and the earlier company became the Detroit and Lake Superior Copper Company, with a capital of $50,000, and still controlled by Waterbury men. This company, like its predecessor, did no mining, but simply prepared the product of the roasters for the market. Until after 1870 the smelting of Lake Superior copper was controlled by this company. As after

*"Travels through the interior parts of North America in the years 1766, 1767 and 1768", J. Carver, p. 139. "Report on Manufactures", Gallatin, 1810, Amer. State Papers, Finance, Vol. II, p. 429.

1865 the mining companies erected their own smelters, the possibility of the indefinite expansion of the Detroit and Lake Superior Company was arrested. The company, however, continued in the business, at times with large profit, until after 1900, when it gradually sold its properties and went out of existence in 1906.

In 1850 the production of domestic copper was 650 tons,* practically all from the Lake Superior region; in 1860 the production was 7,200 tons; in 1870, 12,600 tons; in 1880, 27,000 tons. After 1880 other sources of supply in Montana and Arizona were opened and the production of domestic copper increased largely. In 1879 83% of the domestic supply came from Lake Superior. This proportion has steadily decreased. After 1860 very little copper was imported. After 1875 the export of copper began to reach large proportions. Since then from 45% to 55% of the total United States production has been exported. Now the world's production is upwards of 700,000 long tons,† of which the United States contributes from 55% to 60%.‡

Zinc, the other constituent of brass, was at first imported. In 1867 Wisconsin ores of zinc, smelted at Carondelet, Missouri, began to come to the market. In that year 1,800 tons were reported as produced. The production rapidly increased and after 1870 the brass industry was independent of foreign sources. In 1869 the first exploitation of the lead and zinc fields in southwestern Missouri was begun and these

*See page 50.

†For consumption of copper in the Naugatuck Valley see pp. 98, 101.

‡About ten per cent. should be added to this proportion as given for the United States to cover the production of Canada and Mexico, which is practically all marketed through the United States.

have since been the chief sources of supply. To-day upwards of 200,000 tons of zinc are annually produced in this country, of which about ten per cent. is exported.

It was not until after 1835 that the gross amount of metal handled by the various brass mills of Waterbury and vicinity reached a ton a week. The development of various manufactures, clocks, hooks and eyes, pins and kettles, together with the demand for German silver by the tableware and plating shops, so enlarged the market that the gross weight of metal in the course of six years from 1837 to 1843 increased to more than five tons a week, or about 300 tons a year. This caused an emergence of the problem of transportation.*

Before 1840 there had been three routes over which the traffic was handled. The first in importance was the road twenty-two miles to New Haven. The first turnpike connection out of Waterbury was effected in 1797 over this road.† This was on the direct line between New Haven and Albany. After 1810 there was a weekly stage by this road, which subsequently ran more frequently. This involved a heavy grade, but was the ordinary line of traffic.

Another road extended south seventeen miles to Derby, the head of navigation of the Housatonic River. After 1820 a turnpike connection was had by this route,‡ and as the brass industry grew it was increasingly used. Over this route freight was carried by boat from New York to Derby and thence by team up the Valley. After 1824 regular

*Confer "Early Transportation and Banking Enterprises of the States, etc.", Prof. G. S. Callender, Journal of Economics, Vol. 17, pp. 111-162.

†"Town and City of Waterbury", Anderson, Vol. I, p. 566.

‡Anderson, Vol. I, p. 567.

steamboat connection with New York was maintained.*

A third route which was used to some extent was by road thirty miles east to Hartford and thence by boat on the Connecticut or further by road, as the case might demand.

From soon after 1820 the improvement of the road from Bridgeport north to Derby and Waterbury was urged. Occasional work was done with the result that during the summer teaming was fairly good, but in the winter and especially for six weeks in the spring the question of transportation was a serious one. The demand for road improvement became more insistent with the expansion of the brass business.

If it had not been that at just this time the development of the Derby mill was arrested by the transfer to Ansonia, the manifest advantage in transportation would have seriously affected the Waterbury men. But the Waterbury mills had the command of the market for brass, Mr. Phelps was shifting his location, he had several important projects under consideration, and it was not easy for him to secure skilled workmen; hence he was unable to take full advantage of his opportunity.

It was again Mr. Israel Holmes who came forward as one of the moving spirits in the solution of the problem. He was ably seconded by other leaders in the industry which had so much at stake; by Aaron Benedict, W. H. Scovill, Anson G. Phelps and others. A railroad from tide water at Bridgeport north was chartered in 1845, which charter was amended in 1847 and in 1848.† At first it was in-

*"History of the Old Town of Derby", Orcutt and Beardsley, p. 272.

†"History of the Old Town of Derby", Orcutt and Beardsley, pp. 311-313. "Town and City of Waterbury", Anderson, Vol. II, p. 157.

tended to build only to Waterbury and the capital was fixed at $800,000. It was, however, decided to extend the road to Winsted and the capital was increased to $1,200,000. The brass manufacturers believed that no profit would be received from the operation of the road, but they were compelled to build it to get their material in and out. The Waterbury men declined stock certificates, but raised $30,000 as a bonus and furnished the right of way. Work was begun in April, 1848, and the road was opened to Derby, May 15, 1849, to Waterbury, June 11, and to Winsted, September 24. This Naugatuck Railroad became a large handler of freight and was for its length one of the most profitable pieces of road in the United States. It was ably managed from the first and has played a large part in the development of the brass industry.

Those who undertook this enterprise believed that Waterbury would be the most important point on the line. This expectation was realized. In 1851 the passenger receipts at Waterbury were more than twice those of any other station north of Bridgeport, and the freight receipts more than three times as large. In that year 29% of the gross receipts and 36½% of the freight receipts were taken at Waterbury.

The increase in the business done in the Valley is well indicated by a comparison of the gross receipts of this road. These were as follows:

1850, ...	$145,261.59
1856, ...	237,416.09
1866, ...	494,026.47
1876-7, ...	503,666.97
1885-6, ...	704,336.48

In 1887 the road was leased to the New York, New Haven and Hartford Railroad Co.

During the three years beginning in 1905 this road was double-tracked to Waterbury, many curves reduced and improvements made at a cost which exceeded the cost of building the road at the start.

Before 1850 a second railroad was projected to connect Waterbury with the Hudson River.* This was, however, a longer route and involved some serious engineering problems. The opening of the Naugatuck road satisfied the pressing demand. Many difficulties were encountered and finally the road was opened first to Hartford, January 11, 1855, the extension to the Hudson River not being finished until January, 1882.

Later still another connection was effected, this time from Ansonia to New Haven.† The various vicissitudes which this last project encountered may be best understood as it is noted that the road is less than thirteen miles in length and although the company was incorporated in 1864 the road was not opened until August 9, 1871.

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*"Town and City of Waterbury", Anderson, Vol. II, pp. 160-162.

†"History of the Old Town of Derby", Orcutt and Beardsley, pp. 332-333.

CHAPTER VI.

ORGANIZATION.

Individual initiative. Capital involved. Partnerships and corporations. Labor. Machinery, mechanics and processes imported. Training a native force. Division of labor. Wages. Profits.

AT THE start, and indeed until the industry was thoroughly established, individual initiative played an unusually important part. It may almost be said that the brass industry as it exists to-day in the United States was the creation of half a dozen men. It was the Scovill brothers and Aaron Benedict in competition with them who first saw that the button business had in it the possibility of enlargement and profit. From the Scovill shop came Israel Holmes, who after ten years' connection with the older firm became one of the organizers of Holmes & Hotchkiss in 1830; and afterwards as has been noted was connected with the organization of four other large concerns.* Israel Coe, who in 1829 became Mr. Benedict's partner, was a leading spirit in the Wolcottville Brass Company and was one of the prime movers in the organization of the Waterbury and Detroit Copper Company. All of these men were natives of Waterbury, except Mr. Coe, who was born in Goshen, near by, and moved to Waterbury when twenty-six years of age. And these men, with Mr. Coe's son Lyman and A. G. Phelps, whose interest has been narrated, were active partners and directly assisted in

*These four were the Wolcottville Brass Co., Waterbury Brass Co., Holmes, Booth & Haydens, and Plume & Atwood.

the organization of eight large concerns,* which in 1884 together produced eighty-five per cent. of the output of the Valley, which in turn was eighty-five per cent. of the production of the country. With the exception of the Scovill brothers, who died one in 1854 and the other in 1857, these all lived until after 1870 and saw the industry firmly established. Except Mr. Israel Coe they all died actively connected with the industry to which they had given so much of their enterprise and energy.

In the early days of the industry the amount of capital involved in the business was comparatively small. In 1827, when the firm of J. M. L. & W. H. Scovill was organized and after their predecessors had labored for twenty-five years to establish the business, the value of plant and goodwill was estimated at $20,000.† Aaron Benedict and his associates began in 1823 with $6,500, and in 1829 the capital of the new partnership, Benedict & Coe, was fixed at $20,000. Holmes & Hotchkiss began in 1830 with $8,000.

The capital invested increased rapidly after 1830. In 1834 the capital of Benedict & Burnham, succeeding Benedict & Coe, was $40,000, which reached $100,000 six years later, and while in 1856 the sum was fixed at $400,000,‡ yet this by no means represented the amount invested. In 1838, after Brown & Elton had succeeded Holmes & Hotchkiss, the capital involved was stated to be $75,000. In 1850 when a consolidation of several Scovill interests took place the capital was fixed at $200,000.

*The eight were Scovill Mfg. Co., Benedict & Burnham Mfg. Co., Brown & Elton, Wolcottville Brass Co., Waterbury Brass Co., Holmes, Booth & Haydens, Ansonia Brass & Copper Co., and Plume & Atwood.

†"Town and City of Waterbury", Anderson, Vol. II, p. 276.

‡Anderson, Vol. II, p. 298.


Chas Benedict

The concerns later organized required a larger capital in order effectively to enter the field. For example, the Waterbury Brass Company was organized in 1845 with $40,000, which was increased to $50,000 the same year and successively was raised to $250,000 in 1853. In 1853, when Brown & Brothers became a joint stock corporation after two years as a special partnership, the capital was $200,000. Holmes, Booth & Haydens, organized also in 1853, had $110,000 capital at the start, shortly increased to $400,000.

Regarding the capital invested in the business three facts must be noted. Of the increase in capitalization down to 1870 and in some degree even to the present a large portion represented undivided profits. From the beginning it has been customary to withdraw only moderate amounts and to devote the surplus to the extension of the business. Probably four-fifths of the capital to-day involved in the brass industry in the Naugatuck Valley represents undivided profits. When in January, 1838, the capital of Brown & Elton was temporarily fixed at $40,000, all but $12,000 had been derived from the business.*

Further, in several prominent cases the nominal capital was kept at a comparatively small amount. For example, the nominal capital of the Scovill Company, Benedict & Burnham, Brown & Elton, Waterbury Brass Company, and Holmes, Booth & Haydens for years represented only a small portion of the money invested. This is an indication of the fact already noted that the industry from the start had some of the characteristics of a close corporation.

The third fact of interest with reference to the capitalization of the industry is that frequently, as some special department of the industry acquired sufficient importance to

*Anderson, Vol. II, p. 320.

occupy a separate plant, a new company was formed to cover that department. As early as 1840 the making of brass butts by the Scovill Company was set off to a separate firm. In 1846 the American Pin Company was organized jointly by Benedict & Burnham and Brown & Elton.* In 1849 the Waterbury Button Company took over the button business of Benedict & Burnham.† In 1857 the Waterbury Clock Company was set off by the same concern.‡ And as late as 1880 the famous Waterbury Watch Company was organized as an offshoot of the same parent stock. In 1878 the Ansonia Clock Company was formed to take over the making of clocks by the Ansonia Brass and Copper Company. This clock company is now one of the largest in its line in the country.

All of the older concerns began as partnerships. The law of 1837, authorizing the organization of joint stock companies in the State, defining their privileges and their powers, was a notable achievement in the line of legislative encouragement of industry. This made easy and practicable the combining of capital in a manufacturing venture, and the brass men in the Naugatuck valley shortly availed themselves of the privileges secured. The first brass venture to be incorporated was the Wolcottville Brass Company, May 19, 1841, succeeding the partnership formed in 1834.§ The first joint stock company in Waterbury was the Benedict & Burnham Manufacturing Company, incorporated January

*See page 60.

†Anderson, Vol. II, p. 298.

‡The entire capital stock of the clock company, representing invested earnings of the Benedict & Burnham Company, was given as a dividend to the stockholders of the parent concern.

§"History of Torrington", Orcutt, p. 102.

14, 1843.* In 1850 the Scovill Manufacturing Company was incorporated. Brown & Elton was never incorporated. In 1853 Brown & Brothers was incorporated after two years as a partnership. Before the incorporation of Holmes, Booth & Haydens in 1853, only one of the earlier companies had been incorporated from the start, namely the Waterbury Brass Company, formed in 1845.

But if the question of capital was important, that of labor was far more important. At the very beginning the members of the firm had personal charge of the bookkeeping and general management; they were also the selling agents† and moreover were the foremen and machinists. Members of the firm worked in the shops directing personally the operations of their employees.‡ They drew pay as their employees, expecting to receive further remuneration from the profits of the enterprise. The training of a force of skilled labor was a matter of time and was undertaken under great difficulty. It is not easy to teach another what the teacher does not know himself; and the best of those who were trying to establish the new industry were hardly better than experimenters.

It is no exaggeration to say that the brass industry was imported from England in machinery, processes and labor. Except for Jerome's application of rolled brass to clock making in 1837 and the perfection of the pin machine and sticking device about 1840, there was no single radically improved machine or process of large importance invented by purely American skill until Mr. Hayden invented the spin-

*Anderson, Vol. II, pp. 297, 431.

†See pp. 75, 76.

‡When the first firm, Abel Porter & Company, employed altogether thirteen workmen, four of that number were members of the firm.

ning process for making round articles from sheet brass, December 16, 1851. After this the advance in manufacturing processes inaugurated by native ingenuity was real and rapid; notably first in connection with the making of lamps and fittings for burning kerosene oil, and later with the use of sheet brass for ammunition cases and many other applications of the metal to marketable wares.

The records of the patent office reveal the fact that the inventive ingenuity of Waterbury men was not in striking evidence until after 1850. Twenty-seven patents are recorded as granted to Waterbury men before 1850. Of these two had to do with clock making and four to the button manufacture. On the other hand, during the decade 1851-1860, eighty-eight patents were issued to Waterbury men, of which the most important were in connection with the brass industry.* And in 1890 the number of patents issued to residents of this city was in the proportion of one to 405 of the population, while in the State as a whole the proportion was one to 796, and Connecticut stood at the head of all the states in this particular. It is apparent that inventive genius was active at the center of the brass industry to a notable degree.

But in the beginning the first rolling of copper in this country by Paul Revere in Canton, Massachusetts, was done with rolls imported from England. The Soho Copper Company, established in Belleville, N. J., also imported its machinery from England.† The process of casting pewter buttons in Waterbury was learned from an Englishman. Both of the earliest enterprises depended for their final success upon English machinery and English skill.

*Anderson, Vol. II, pp. 471-472.

†See page 43. "100 years of Amer. Commerce", C. M. Depew, article by A. A. Cowles, Vol. I, p. 333.

Leavenworth, Hayden & Scovill dated their real beginning of success from 1820, when Mr. James Croft, an Englishman, entered their employ. After remaining with them one year he was secured by Mr. Benedict and in 1829 he became one of the partners of the firm of Benedict & Coe, then organized. It was largely due to the advice and encouragement of Mr. Croft that the venture was continued. Trained in the art of making gilt buttons in Birmingham, England, he was the first workman of technical skill whose name appears in connection with the infant industry. His knowledge of the needs of the business here and as well of conditions in Birmingham led Mr. Benedict to send him seven times to England for tools and workmen.* It was Mr. Croft who secured for his employer the machinery which enabled him to compete successfully with the older firm, Leavenworth, Hayden & Scovill.

Mr. Israel Holmes made three trips to England in search of machinery and labor. The first was in 1822, after Mr. Croft had left the Scovill shop for Mr. Benedict, when the older firm saw that they needed skilled workmen and improved machinery. At the time the laws of England, in order to prevent enterprising manufacturers in the United States and elsewhere from profiting from the industrial development of the island, forbade under heavy penalties the exportation of machinery or models and the enticing away of workmen from their employers. Mr. Holmes offered an excessive price for machinery needed and so obtained through the manufacturers permission to export it. He then endeavored to secure workmen and finally after much cautious effort he assembled a party of men who with their families numbered a full score. The outcome of the ven-

*Anderson, Vol. II, p. 315.

ture was improved machinery for the Scovills and an expert die-sinker, gilder and burnisher.*

Again in 1831, after the new firm of Holmes & Hotchkiss was established, Mr. Holmes made a second trip to England and secured the machinery and skilled labor needed for the new plant.†

His third visit was in connection with his venture in 1834 with Mr. Coe, Mr. Phelps and others in the making of brass kettles in Wolcottville. By this time the English government was thoroughly aroused to the danger which his presence involved. At first he hired two men, one of whom died in Philadelphia the day after his arrival, and the other never reached Wolcottville. He continued, however, until he had gathered a company of thirty-eight, including all of the members of families engaged. After great difficulty in escaping from those who were seeking to enforce the law, he got his company out of the country and landed them at Hartford. This was the largest band secured by any of the brass men at one time. The company went by road to Wolcottville to find that the mill was not ready. It was impossible to keep all of the men together, but enough remained to establish the industry. However, the final success of the venture was not achieved until after 1842, when Mr. Coe visited the only two known kettle factories, one in Prussia and the other in Birmingham, and secured the right metal mixture and the proper annealing process.‡

Again, in 1836, Mr. Phelps fitted out his Derby mill with machinery secured in England and obtained some workmen there. Also the same year the formula for German silver

*Anderson, Vol. II, pp. 322-323.

†See page 52.

‡Anderson, Vol. II, p. 302. See page 55.

was bought from an Englishman by a workman employed in a shop which depended for its success upon English sources.*

Besides these efforts which were made to persuade English workmen to come to the Naugatuck Valley and to assist in the organization of the brass industry, many individuals came thither of their own initiative. Mr. Croft himself was one such, quite probably coming to America with no deliberate intention of making direct and effective use of his early training. Mr. Wallace, who was of great assistance to Mr. Phelps in his Derby venture and who later organized Wallace & Sons in Ansonia, was a wire drawer trained in Birmingham and had been in this country in various places for nine years before he came to Derby.†

By no means all of those who were enticed away from their native land were competent workmen. On one occasion it was found that an Englishman whom Mr. Holmes had secured in 1831 for Holmes & Hotchkiss was unruly and intractable. His passage was paid back to England in order to prevent any competitor from securing his services.

Again, the Englishmen appreciating the importance of their knowledge and skill, in many instances refused to instruct native apprentices. The wire drawers whom Mr. Holmes first secured for Holmes & Hotchkiss refused to allow apprentices near their machines while they were in operation. For several years the English kettlemen in Wolcottville insisted upon occupying a separate building into which no American was allowed to enter. But the alertness, ingenuity and skill which had called the industry into being was not so easily baffled, and before long a force

*See pages 33, 34.

†See page 63.

of workmen was trained which was able to handle the business which might be offered.

The last important process which was secured in England was that of making seamless tubing. This process had been invented in England in 1838.* In 1848 a party of Boston men sent an engineer to England, who by the payment of a large sum of money secured the desired knowledge.† The American Tube Works was organized in Boston in 1850 to make use of the new process. But at that time the Waterbury men were in a position to manufacture tubing at a greater advantage than the Boston company, and while that company has continued in operation, yet the process was soon learned by the men in the Naugatuck Valley and a large production of tubing has been made. Now the output of tubing, both seamless and brazed, is an important item. The English process was to cast a cylinder of brass and then to draw it over steel arbors. This is still in general use, but the effort is now being made to draw tubing directly from solid ingots of metal.

While thus before 1840 the brass industry in America was practically dependent both upon English machinery and upon English skill, yet during the following decade it became thoroughly acclimated and after 1850 it forged clearly ahead of the English shops. To-day, owing in part to the fineness of the copper and zinc which are here mined, as well as to the ingenuity and skill of American labor, the Connecticut mills in fineness of work and of finish rank at the head of all those in any land in this industry.

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*"British Manufacturing Industries", Bevan, article by Graham, p. 148.

†"100 years of Amer. Commerce", C. M. Depew, article by Cowles, Vol. I, p. 335.

From the first the labor in the rolling and wire mills has been male. In the manufacturing departments, especially in the smaller and finer wares, females have been freely employed. In the rolling mills the work is too harsh and heavy for women.

Owing to special conditions which have prevailed from the beginning no scale of wages has ever been adopted in the brass mills. There has never been any serious or general strife over the question of wages or of conditions of labor in the history of the industry. No labor union or other combination of the skilled labor in the industry has ever been effected.

At the very beginning, as has been noted, the proprietors were the skilled mechanics, if the term may be allowed by contrast. In the years from 1830 to 1850 there were, roughly, three classes of labor; the proprietors actively engaged in the management, the English mechanics and native helpers. By 1850 the supplanting of the English mechanics by American workmen, who had either been taught or had by themselves developed skill, had been generally accomplished.

To the present time the number of skilled men is comparatively small. The division between skilled and unskilled labor is now sharply defined. A skilled caster, drawer or roller will have from two to five unskilled laborers under him. A considerable amount of intelligence and ingenuity being required, the skilled labor is of a high grade. From 1850 to 1870 native Americans predominated. Now, while a few Americans remain, yet the best positions in the mills are more generally occupied by the higher grade of immigrants of the second generation. The policy generally adopted by the mills has been to pay skilled laborers high

wages. The result has been to attach these closely to the plant in which they were employed. Many own their homes and are in very comfortable circumstances. The unskilled labor, at the first American, became Irish after 1850, and has since followed the successive waves of immigration.

As early as 1835, as it was found that the kettlemen at Wolcottville were unwilling to train apprentices, the system was adopted of regulating their pay by the pound of product. Under this stimulus they were persuaded to employ American helpers. This system of paying a skilled mechanic a fixed price per unit of product still obtains in some departments. The mechanic then hires his own helpers, using machinery furnished by the proprietors. This system, together with the fact that individual skill plays such a large part in the value of some workmen, has made a uniform wage scale impracticable. The first American helpers were paid twenty dollars a month, this being increased to a dollar a day by 1850. After the war the wages of skilled mechanics were raised to two dollars and a half a day, and have varied since then, running up to five and six dollars a day in exceptional cases. Unskilled labor has received wages also varying in amount with the value of the service rendered, but usually averaging about the market rate for such labor. Between 1850 and 1860 the helpers received a dollar to a dollar and a quarter a day; since 1870 from a dollar and a quarter to a dollar and a half a day.

The system adopted has tended to the development of specialization and unusual skill in the head mechanics. To this day some of the men having in hand some special line of work are reluctant or absolutely refuse to impart their special skill to others.

It has already been stated that in the early years of the

industry the profit was large.* The fact that the proprietors drew wages at a fixed rate and then allowed their profits beyond their immediate needs to accumulate in the business both made the accumulation of capital comparatively easy and also in part concealed the profits of the enterprise.

The selling price of the product of the brass mills has been determined in part by the market price of copper. In the decade from 1840 to 1850, when the business first came to notable proportions, at times sheet brass and wire sold delivered at the market for three times the price of copper. When manufactured into buttons, kettles, pins and other wares, the selling price of the product was even higher than this The labor cost for sheet brass was not over fifty per cent. of the price of copper and probably for many wares the labor cost was not more than equal to the cost of the raw material. This indicates clear profits of one hundred per cent. over the cost of raw material and of labor. It is probable that at times this profit was realized.†

After 1850 competition became more keen and profits were lessened. Still until 1870 sheet brass and wire were sold at least on occasions twice the market price of copper. After this date, however, the selling price of the product of the mills fell quite rapidly in its relation to the price of copper. Competition became more keen. At times importations, notwithstanding the duty of 35%, were large. From 1870 to 1885 consumption gradually increased, yet an overproduction was hardly prevented even by strict pooling agreements.

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*See page 51.

†Allowance in this estimate is not made for charges for interest, operation of the plant, depreciation and to a degree for transportation.

The price of copper has varied somewhat from time to time. Until 1860, when the domestic supply began to command the market, it had run from fifteen to thirty cents a pound. Zinc had been more steady, averaging about ten cents a pound. Through this period the price of sheet brass, which about 1840 had been as high as sixty or eighty cents, transportation included, worked gradually down to from thirty-five to fifty cents a pound from 1855 to 1860. The price depended upon the thickness of the sheet. The thinner the sheet, the higher the price. At this time brass wire was from thirty-five to forty cents a pound. Copper wire usually commanded about ten cents more than brass wire. From 1860 to 1875 the price of copper was subject to the fluctuations which prevailed in all commodities and varied from forty-six cents in 1864 to twenty cents at the end of the period. The margin of profit in the brass mills had been lowered by this time and the price of brass followed the price of copper. For twenty years after 1875 the tendency of both copper and brass was toward lower prices. The expanding production of copper from the mines of Montana and Arizona more than kept pace with consumption. But after 1895 the largely increased use of copper for electrical machinery consumed surplus stocks and made speculation in the price of the metal possible. There have been two periods of such speculation, when the price was artificially raised, once in 1901 and again in 1904. Except for such fluctuation the price of copper has held at between ten and fifteen cents. The price of zinc has been more steady throughout the period under review, having been from seven to ten cents, gradually dropping to five cents, as production has run a little ahead of consumption. To-day the price of sheet brass and of wire in the coarser

grades runs a little above the cost of the alloy. The difference between the price of copper and of zinc in the proportion in which the two metals enter into the composition of brass is the measure of the profit now gained. In the finer grades of sheets and of wire the labor cost increases rapidly and prices vary accordingly. The prices of the various manufactured products are fixed by the law of supply and demand. Patent rights, secret processes, special machinery, all enter into the question of final profit. This varies with the special conditions of the market.

CHAPTER VII.

Later Developments.

Review of growth and development. The telegraph and electricity. The metallic case cartridge. Coinage. Foreign trade.

NOW as the beginning and establishment of the brass industry in the Naugatuck Valley has been traced it will be in order to note its later development.

In the early years of button making, after 1810, it was necessary for Mr. J. M. L. Scovill, then of Leavenworth, Hayden & Scovill, to make a monthly trip to the rolling mill at Bradleyville to secure the rolling of the metal needed.* In 1822, the last year in which the making of rolled brass buttons was carried on by this firm alone, the output was about twenty gross a day.† By 1843 there were located in Waterbury three factories for the rolling of brass, the Scovills, Benedict & Burnham, and Brown & Elton. These employed together perhaps six hundred hands‡ and used 250 tons of copper a year.§

By 1855 the industry had extended to Ansonia on the south and to Torrington on the north, with a total annual consumption of copper in the Naugatuck Valley of about 2,000 tons. As has been noted, at this time the Waterbury Brass Company was the most important single concern. This company controlled two plants and was thought to be

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*"History of Waterbury", Bronson, p. 429.

†"Town and City of Waterbury", Anderson, Vol. II, p. 276.

‡"The New England Gazetteer", Hayward.

§"100 years of Amer. Commerce", Depew, article by Cowles, Vol. I, p. 332.

the largest in the trade in the country. Its gross output was about 300 tons of metal a year, or not quite a ton each working day.

By 1867 the amount of copper used in the Valley had risen to 6,000 tons a year. At this time the Ansonia Brass and Copper Company, handling about 1,250 tons of metal a year, had come to be the largest single concern. When just after 1870 this company was able to report that 250 tons of metal had passed through its mills in one month, this was thought to be a notable achievement. This same concern has in recent years handled more than 2,500 tons of metal in one month. In one of the mills controlled by this company are located what are thought to be the heaviest rolls in the country or in the world devoted to the rolling of brass, 72 inches long and 24 inches in diameter. The heaviest rolls for copper in the Valley are also in the hands of this company, 120 inches long. Longer copper rolls than these, however, are owned by the Soho Copper Company, 156 inches long and 30 inches in diameter.

The casting of copper and of brass, as has already been noticed, is an art which is relatively independent of machinery and of the factory system and has never been localized as is the rolling of brass.* The rolling of copper requires no mixture of metal and except in its finer forms its technique of manufacture is much less demanding, and hence this also has never been localized as is the rolling of brass.

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*See p. 44. In the years named, according to the census returns, the following is the percentage of the total production of brass casting and finishing in the United States which proceeded from the State of Connecticut: 1880, 10%; 1890, 30%; 1900, 31%; 1905, 10%. Of brass casting and finishing in Conn., the following proceeded from Waterbury: 1890, 50%; 1900, 88%; 1905, 82%.

It is worthy of note that since 1869, when the association was organized from which the Plume & Atwood Manufacturing Company has developed, until 1900, only two new concerns which are to-day in operation have been organized in the Naugatuck Valley. One of those, Randolph & Clowes, began business in 1886 in order to make use of the plant of Brown & Brothers, which corporation was at that time in liquidation. The other new company is the Seymour Manufacturing Company, located at Seymour, organized in 1878 and now doing a good business.

From the first Waterbury has been the recognized center in the country of the brass industry, and within the city itself this has of course been the leading industry. In 1858 there were in Waterbury thirty-two corporations or partnerships, of which twenty-five were in the brass business.* In 1873 there were thirty-five joint stock companies within the city, of which twenty-seven were in the brass business.† In 1896 there were one hundred and eight corporations located in the city, of which thirty-nine, the largest single group, were in the metal working business.‡ According to the census returns,§ in 1890, 31% of the brassware in the United States and 40% of the brassware of Connecticut came from Waterbury. In 1900, 48% of the brassware of the country and 88% of the brassware of the state came from Waterbury. For 1905 the corresponding figures are 42% and 82%.

The development of the industry may well be seen from the following figures relative to the operations of a typical

*"History of Waterbury", Bronson, pp. 561-563.

†See City Directory, Waterbury, 1873.

‡"Town and City of Waterbury", Anderson, Vol. II, p. 433.

§See criticism of census schedules on pages 2, 3.

concern, the Scovill Manufacturing Company, from the date of its incorporation.*

	1850	1860	1870	1880	1892
Number of employees....	190	193	338	399	1,200
Horse power used.....	80	200	200	340	1,400

In 1907 the company employed about 3,500 hands.

In 1880 the Benedict & Burnham Manufacturing Company reported that it was using 400 steam horse power and two water wheels and employed 600 hands.†

In 1884 the gross weight of metal used in the Naugatuck Valley had risen to 20,000 tons, increasing in 1895 to 110,000 tons, in 1903 to 160,000 tons and in 1907 to 200,000 tons.‡

The rapid increase in the consumption of copper after 1885 was due to the demand for electrical purposes. To-day nearly one-half of the total consumption of copper in the United States is used for wire for electricity And this wire is largely produced in the mills in the Naugatuck Valley.

It was in June, 1844, that Professor S. F. B. Morse constructed his first telegraph line from Washington to Baltimore.§ At the first copper wire was used exclusively and the wire mills in Waterbury and Ansonia were the only ones in this country which could supply this material. But later various cheaper substitutes for copper were used and

*Scientific American, Dec. 13, 1879, Vol. 41, p. 380. "Town and City of Waterbury", Anderson, Vol. II, p. 275-278.

†Scientific American, May 1, 1880, Vol. 42, p. 277.

‡To some extent metal is figured twice in this gross output; as the product of rolling mills, and again as brassware, the manufactured product.

§"History Amer. Mfrs.", Bishop, Vol. II, p. 408.

the more imperative demand for electrical appliances did not arise until after 1880. The telephone and the trolley consume vast quantities of copper wire. At present electrical machinery and devices demand copper sheets of such fineness and exactness of measure that the rolling of copper has become a much nicer operation than it was in the earlier days. To roll copper to the thinness which is now required demands rolls of a fine finish and skill to a high degree.

One other application of brass to marketable wares which at the time contributed largely to the business of the rolling mills must also be noticed. This new demand came just at the close of the Civil War and was of large assistance to the industry at that critical period. It is noteworthy that at the time of the three earlier important commercial crises the industry met conditions which particularly favored it. It was in 1837 that Jerome perfected his rolled brass clock. This occasioned an immediate and largely increased demand for brass. While the Derby copper mill just established and the Waterbury men felt the distress incident to the commercial crisis, yet they were able to continue in operation. In 1857 a real and extensive market had been established. By this time the domestic demand was well known and the mills in the Naugatuck Valley were alone able to supply that demand. While for a time the mills ran light, yet the various companies agreed to sustain prices and so divided up the production that no one suffered severely. And in 1873 the demand for rolled brass which arose in connection with the making of the metal case cartridge was an important factor in enabling the rolling mills to face unfavorable conditions. It is worthy of note that not a single brass mill was compelled to undergo liquidation in either of the three earlier crises. Later, in 1883 and 1893, when the margin of profit

had been reduced and when competition was more keen, the rolling mills did not so universally escape.*

The first metallic cartridge was made just after 1861 by Smith & Wesson in Springfield, Masssachusetts. But this firm was more interested and skilled in the handling of ammunition than in the making and rolling of brass. The demand for arms and ammunition was very imperative and they abandoned their experiments. The Waterbury Brass Company took up the matter and continued the effort to find and to use a metal mixture which was adapted to this purpose. In 1863 Lyman W. Coe, the son of Israel Coe, went out from the Waterbury Brass Company and, purchasing the plant of the Wolcottville Brass Company, organized the Coe Brass Company and applied himself specifically to this problem. Here complete success was attained and later the Coe Brass Company thus established expanded its business and is now one of the leading factors in the trade. It appears that between 1890 and 1895 the Coe mill at Torrington operated some of the heaviest machinery in the world used for the rolling of brass and was the most important plant in the country devoted exclusively to the rolling of metal and the drawing of wire.

After 1870 the business of rolling metal for ammunition cases was taken up by other mills and for a few years was a very important item in their trade. In 1860 8% of the national product of ammunition came from Connecticut. In

*Before 1860 the Wolcottville Brass Co. was the only one which found itself in a critical condition, and this was due not to a commercial crisis, but to the invention of the spinning process and the subsequent securing of its workmen by A. G. Phelps. See page 55. Later Brown & Bros. was liquidated in 1886, and Wallace & Sons in 1895. See pages 63, 64.

1870 this proportion had risen to 85% and in 1880 to 90%. Since that time the making of ammunition has been relatively less important, Connecticut's contribution falling to 59% in 1890, rising again to 75% in 1905.

One incident in connection with the story of the brass industry remains to be noticed; one of not large consequence to the industry itself, but one of practically universal personal interest.

The first copper coinage of the United States Government was undertaken by Connecticut men and was continued by the Scovill Company in Waterbury. As early as 1737 one Joseph Higley made a set of dies and struck from copper from the Granby mine the first copper coin made in America.* These have almost entirely disappeared, but for a time they passed current over a large part of New England.

On October 18, 1785, Joseph Hopkins of Waterbury with four New Haven associates applied to the State legislature for permission to coin coppers, alleging a scarcity of small coins in the State. He was given the privilege of making copper coins not to exceed in value £10,000. This privilege was variously conveyed until June 1, 1787, when it was revoked. Up to that time some 29,000 pounds of copper cents had been issued, valued at nearly £4,000.† Granby copper was used in the main for this coinage. A contract was entered into in 1787 with the United States Government for

*"Coins, medals and seals", Prime, pp. 70-72. "Newgate of Conn.", Phelps, pp. 15-17. "History Amer. Mfrs.", Bishop, Vol. I, p. 510. New Haven Colony Historical Society Papers, Vol. I, 1865, Pt. II, p. 181.

†New Haven Colony Historical Society Papers, Vol. I, 1865, Pt. II, p. 176. "Town and City of Waterbury", Anderson, Vol. III, pp. 1054-1055.

the coinage of 300 tons of copper coin. This contract was never filled.

Later on, in 1834, it was the Scovill Company, doubtless with this earlier history in mind, which challenged the exclusive right of the United States Government to issue coins. During the next seven years many tokens were issued by them of nearly two hundred different designs.* The most of these were stamped from sheet copper, although a few were alloyed with tin. These passed as current coin even after their manufacture ceased. In 1842 the issue was enjoined by the Government. After 1866 the Scovill Company furnished the United States mint with blanks for the three cent nickel and after 1890 with blanks for the one cent bronze and five cent nickel coins. Many coins, both blanks and fully stamped, have been issued by the Scovills and by others for many South American states.†

The most notable achievement in the history of the country in the line of medal making was when the Scovill Company furnished the full set of medals, 23,757 in number, for the Columbian Exposition of 1893. These were particularly rich and full in design, and special machinery and processes were devised for their manufacture.‡

The brass manufacturers have been content in the main with the effort to supply home consumption. As the nation has grown and as industry has developed, the consumption of copper with brass and other alloys has naturally increased and many new uses for various alloys have been found. To

*"Town and City of Waterbury", Anderson, Vol. III, pp. 1057-1059.

†"Town and City of Waterbury", Anderson, Vol. III, p. 1059.

‡"Town and City of Waterbury", Anderson, Vol. III, pp. 1060-1061.

supply this home demand has been the effort of the rolling mills. The foreign trade generally has not figured to any large extent in the business.

For the year ending September 30, 1823, brass manufactures at an invoice value of $259,214 were imported.* For the year ending June 30, 1845, such imports are returned as $120,083.† The same year the value of brass manufactures in the State of Connecticut was returned as $1,126,494. From 1840 to the present time imports of brassware have generally been a negligible quantity. During the period from 1867 to 1893, except for the eight years from 1880 to 1887 inclusive, when imports of brasswares averaged $400,000 a year, there were but two years, 1874 and 1875, during which the invoice value of brass manufactures equalled the amount reported for the year ending September 30, 1823.‡ With the exception of the period noted, 1880 to 1887, imports have not averaged one per cent. of the total consumption.

It was during the period excepted, 1880 to 1887, that the profits of the industry were probably smaller than at any time since 1840. During some of these years some of the largest plants were operated at a loss. It was at this time that Brown & Brothers failed and Wallace & Sons ran so far behind that later liquidation became necessary. Copper was being produced in larger quantities than it was being consumed, prices were falling and the trade was generally dis-

*Report of Sec. of State, Jan. 27, 1824: made to 18th Cong., 1st. Session.

†Report of Sec. of Treasury, July 23, 1845: Senate Doc. 444, 29th Cong., 1st Session.

‡"Imports and exports, etc.", March 14, 1894: Senate Report No. 259, 53rd Congress, 2nd. Session.

organized. As has been noted, the tariff acted at this time more effectively than at any other in the history of the industry in discouraging foreign competition. It was during these years, from 1870 to 1874, and from 1880 to 1887, that the imports of copper and its manufactures, and of zinc and tin as well, reached the highest figures in the history of the industry.

The first entry which is on record of exports of copper and brasswares is for the year 1791, when a value of $493 is returned. The next entry bears date of 1803, since which time such exports have appeared in the returns of each year.*

However, the amount of such wares which were exported was not large until after 1840. At this time the only item of brass manufactures which was considerable was brass clocks. This contiued until 1900 the most important single manufacture connected with the brass industry which was available for export. In the decade 1861 to 1870 the value of clocks and parts exported was more than ten times as great as that of all other brass manufactures combined. In the decade 1871 to 1880 the export value of clocks was more than twice as great as that of all other brasswares and during the next decade nearly four times as great. Down to 1900 generally the export value of clocks has been more than twice as large as that of all other brasswares combined.

Since 1900 a consistent effort has been made to secure a share in the foreign trade. At present the most promising field is along the line of electrical equipment. The purity of the metal available, together with the high degree of perfection which the machinery and skill in the Naugatuck Valley mills have attained, furnishes a product which it is believed

*"Imports and exports", March 14, 1894: Senate Report 259. Also House of Rep. Miscel. Doc. 29, March 3, 1883.

is more exact in scale measure and possesses a higher degree of finish than can be obtained elsewhere in the world. The development of this electrical demand as it came in this country after 1885 was the most important single item which has ever appeared in the history of the industry. While the metal used is largely copper, yet the mills in Connecticut were better equipped than any other to meet the demand when it arose.

The perfection of the brass clock and the making of German silver, the use of wire for the making of pins and of hooks and eyes, the manufacture of tubing and of photographic plates, the invention of the spinning process for making hollow ware, the development of the burner for kerosene oil, the development of the rim fire cartridge and the electrical demand mark the successive steps of large consequence in the history of the industry. And of all these the possibility of the application of electricity to industry and the demand for the use of metal in large quantity in this connection is easily the most important.

In this connection certain products of the mills have already been accorded favorable notice in the world markets. One item of special note has been the making of transmission cables for high power electrical plants. Single orders for as much as five million pounds of such cables have been received for export. It is believed that in this line a profitable trade can be developed. Also in certain other products of the brass mills, as they are now organized to handle copper and its various alloys, it is confidently expected that an export trade of considerable dimensions can be secured.

After 1860 the export trade in raw metals, copper and zinc, began to reach large proportions. The first entry of pig copper specifically so itemized appears in 1864. From

that year to 1870 an average value of over $700,000 in ore and in pig copper was exported. This average value was more than doubled during the next decade, increased more than three times again from 1881 to 1890 and since has figured largely in the export trade. Since 1900, including the product of Canada and Mexico which is marketed through the United States, raw copper exported has amounted to 250,000 short tons in a single year, which at fourteen cents a pound reaches a respectable figure. This is now the largest single item of export in the metal group. The first export of zinc returned is 95,738 pounds in 1863. Except for the years 1871 to 1876 and 1883 to 1889, when as already noted the trade was somewhat disorganized, the export of zinc has been large. Now it runs up to 20,000 or 25,000 tons a year.

CHAPTER VIII.

Competition and Combination.

Notable development of the brass industry in the Naugatuck Valley. Factors which influenced the development. Outside competition. Roll of mills in 1895. Pools and agreements. American Brass Company. Review and conclusion.

THUS far the story of the development of the brass industry in the Naugatuck Valley has been written from the outside, as it were. It remains to consider conditions from the inside, to indicate in a measure why the industry developed as it did, to note the relation of the different plants to each other and the action which was taken to control the market. The control of the market has been extraordinarily effective from the very first. At least until 1900 the amount of rolled brass and brass wire produced for the open market outside of the Naugatuck Valley has been a negligible quantity, at no time amounting to ten per cent. of the total production.

Within the Valley certain remarkable facts have appeared. In 1870 there were from Ansonia to Torrington ten brass mills and two copper mills. Of the ten brass mills, one had been organized in 1869. Of the other nine, seven may fairly be placed in the first class. The other two, while important, were relatively smaller. Of the seven first-class mills, five had been organized in the twenty years from 1834 to 1853. And from 1870 to 1900 only one additional plant was located.

Furthermore, one man, Mr. Israel Holmes, had been intimately connected with two and had been instrumental in the organization of two more of the seven plants of first rank and had been active in the organization of one of the two smaller plants as well as the last one in 1869.

Moreover, if one had after 1870 attended the stockholders' meetings of the various brass companies, of the subordinate concerns as well as of the rolling mills, he would have met in general the same group of men. For example, Mr. J. S. Elton at one time had large investments in four of the largest mills, as well as in many subordinate enterprises; and Mr. G. W. Burnham was a large holder of the stock of at least three of the most important plants. This list might be indefinitely extended.

From the point of view of current ideas regarding the organization of industry it seems quite incomprehensible that a man would aid in the establishment of a new plant which might compete with himself as the owner of a mill already in operation. There are, however, three facts which may help to explain the development as it actually took place.

First: certain capitalists, some of whom had found the business profitable, believed in it. They believed in the present and in the future of the brass industry. They argued that if one company failed another might succeed and all could not fail.

Second: personal jealousies and internal strife caused dissensions which led to splits in associations already formed and to the organization of new enterprises.

Third: in several notable instances personal ability and genius were important assets in a given undertaking.

It may not be easy to differentiate these three items, but their action together may be easily illustrated. For example,

Mr. Israel Holmes possessed an unusual notion that there were very definite limits to advantageous growth. He believed that the limit of the profitable operation of an existing plant was attained when a certain size was reached. If further development was to be had a new organization was necessary. His own ability as an organizer and a salesman was generally recognized as of a commanding order and he easily persuaded capitalists to finance his new undertakings.

Again the possession of certain patents relating to the pin manufacture had a direct and a large influence upon the demand for brass wire. The single invention of Mr. H. W. Hayden of the spinning process affected vitally the history of four concerns: the Wolcottville Company whose business was by it undermined; the Brooklyn Brass Company which failed in an attempt to infringe upon it; the Waterbury Brass Company which temporarily became one of the most important plants in the Valley, in part because of its control of this patent; and the Holmes, Booth & Haydens Company which counted as one of its most valuable assests Mr. Hayden's inventive skill which had been thus illustrated and proved.

The action of some of the influences to which reference has been made may appear in connection with the organization of some of the new concerns. At the start, the partnership which later became the Benedict & Burnham Manufacturing Company was organized to compete with the older venture simply in the making of brass buttons. The next concern, which became Brown & Elton, was started to roll brass and to draw wire for market, as some outside demand had appeared at this time and the two older firms were not directly interested in it. In this connection Mr. Holmes appeared first as an organizer, as he left the Scovill firm to

Isaac Holmes

engage in this new enterprise. His restlessness, together with an effort to make brass kettles, was a large factor in the establishment of the next enterprise, the Wolcottville Brass Company. Mr. A. G. Phelps started the venture out of which the Ansonia Brass and Copper Company grew, in part because of a disagreement with his associates at Wolcottville and in part as an effort to supply his trade with the product of his own mills rather than to depend upon importations. The Waterbury Brass Company was born, as a man who had a water privilege thought to use it and enlisted the coöperation of Mr. Holmes and others who were somewhat uneasy in their partnerships in Waterbury and in Wolcottville. One of the reasons joined to Mr. Holmes' restlessness for the organization of Holmes, Booth & Haydens was the belief that the Scovills were making large profits in the manufacture of daguerreotype plates. And the concern which became the Plume & Atwood Manufacturing Company was the outcome of a disagreement in an older company. Thomas Wallace started his enterprise in Ansonia, and Thomas James his in Seymour, because they both thought they could make more money in plants of their own rather than as employees in the established mills. After the beginning of what came to be the Benedict & Burnham Manufacturing Company in 1823, there was not a single enterprise in existence in 1900 in Connecticut or outside of it, except the Manhattan Company of New York City, which had been organized independently of the mills in the Naugatuck Valley. In every case up to that time new plants were either located by those who had gained experience in the Naugatuck Valley, or were manned by workmen who were here secured, and in almost every instance by both.

But now when once organized the various plants at times

actively competed with each other and together faced some competition from without. The story of competition from without will first be told and then the way in which the mills of the Valley acted together to meet this competition and to secure their own interests.

During the forties there were two or three small concerns besides those which have been mentioned which were rolling small quantities of brass and making some brasswares. At this time a considerable proportion of the rolling of copper was outside of Connecticut. Until after 1885 the handling of copper was not the most important item in the business of the Naugatuck Valley mills and while to-day the proportion of copper which is used pure is larger than ever before in its relation both to the whole business of the Connecticut mills and the total consumption of the country, yet these mills do not now exercise the same measure of control of the trade in copper sheets and wire as they do of that in brass and other alloys.

The early competition was in the hands of small concerns, only one of which long lived. At no time before 1860 was such competition effective enough to call for remark. The first pretentious effort to compete with the Naugatuck Valley mills began in 1853. In that year Mr. John Davol, who had taken the place of Mr. A. G. Phelps when he left the Wolcottville Brass Company in 1848 to establish his own plants in Derby and later in Ansonia, with two associates in the Wolcottville Company, went to Brooklyn, New York, organized the Brooklyn Brass and Copper Company and began the rolling of brass and the manufacture of brasswares. At that time the business of the Wolcottville Company was being seriously affected by Mr. Hayden's invention of the spinning process for making brass kettles. Mr. Davol also

had had some disagreements with his Wolcottville partners. With other wares he undertook the making of brass kettles and infringed upon Mr. Hayden's patent. This involved him in a lawsuit, the result of which was that he was compelled to abandon this line of manufacture. This incident inspired in him such hostility to the Connecticut men that from that time he refused to enter into any agreement to maintain prices. However, his own financial interest led him in the main to follow the price list agreed upon in the Naugatuck Valley, especially as the latter mills generally refused to cut under Mr. Davol's prices. But the Brooklyn Company was always independent and at times was an active competitor. From 1870 to 1890 the plant was in full operation and a considerable product came upon the market. At the time it was the most formidable outside competitor in the trade. After 1890 however its business fell off and in 1903 the land was needed for the anchorage of the Manhattan Bridge and the plant was sold and the company went out of business.

In 1865 two other enterprises were started, which with the Brooklyn Company were the only outside concerns of consequence in the brass business until about 1880. One of these is especially worthy of note because it is the only establishment in the trade before 1900 which was organized independently of the Connecticut mills. In 1865 the Manhattan Brass Company began doing business in New York City. This has always remained out of organic connection with the Naugatuck Valley mills. However self interest has led it in the main to follow the standard price list. Moreover it has never entered the market to any large extent with the product of its rolls. Indeed at times it has been a large purchaser of sheet brass. The interest of the company has

been in the manufacture of various wares. It has in the main rolled metal only for its own use.

Again in 1865 the Bridgeport Brass Company was organized. In the same building in which the Brooklyn Brass and Copper Company had its rolling mill, there had been a small concern engaged in the manufacture of brassware. In 1865 this firm with the active coöperation and financial assistance of Mr. Davol and his son, William H., established a plant at Bridgeport. For fifteen years some business was done, but at no time was the enterprise prosperous. In 1880 Mr. Frederick A. Mason, the son of Mr. Albert A. Mason who had been one of Mr. Davol's associates, with others bought out the Davol interest in the Bridgeport Company. Mr. Mason had been since 1872 in the employ of Benedict & Burnham and was familiar with the trade. Under his management the Bridgeport Company became quite prosperous. However frequently it entered into trade agreements with the mills up the Valley and was never a close competitor for the outside trade.

Down to 1880 then there was no effective outside competion except by the Brooklyn Company. Since that date further competition has appeared and during the last few years this has become increasingly active.

From 1880 to 1900 there were four concerns which emerged as worthy of notice. It is to be remembered that from 1869 to 1900 only one strictly new plant was organized in the State of Connecticut, the Seymour Company in 1878, which has remained comparatively small and which while it generally did not enter into trade agreements with the other mills nevertheless in the main has maintained the standard prices. The four outside companies are The Bristol Brass and Clock Company, located at Bristol, Connecticut; The

Rome Brass and Copper Company, organized in 1879 and located at Rome, New York; The Detroit Copper and Brass Rolling Mills, organized in 1881, located at Detroit, Michigan; and The Chicago Brass Company, organized in 1886 and located at Kenosha, Wisconsin.

The Bristol Company is the outgrowth of an old attempt, begun about 1850 by men who had been interested in the Wolcottville Brass Company, to manufacture brass clocks. A large business in this line was developed. In the earlier period it was in rather close agreement with the other mills in the vicinity. Until 1890 it did not roll much more metal than was consumed in the factory. Since that date and particularly since 1900 it has enlarged its plant and now actively competes for the outside trade.

The Rome Company was established by local men who thought thus to utilize an abandoned iron rolling mill. They were assisted in this enterprise by men who had gained experience and a knowledge of the trade in the Naugatuck Valley. It has been a rolling mill primarily, has been well managed and an active competitor from the start. It now has a large trade in sheet copper but it also handles brass in sheets, wire, rods and tubes.

The Detroit mill was also organized by men who at the time were in close touch with the Connecticut enterprises and at first pooled its business with the Connecticut mills. It was at the start primarily a rolling mill. Now sheet copper is the largest item in its output but like the Rome Company it produces brass in various forms. After 1890 it broke away from its agreement with the other mills and entered into active and effective competition with them.

The Chicago Brass Company, also a rolling mill, while at

first a competitor, was not largely prosperous. In 1901 it was bought by the Coe Brass Company and now is absolutely owned by that corporation.

Besides the concerns located as already noted in Bridgeport, Bristol, Rome and Detroit there are but two other companies which are to-day actively and effectively competing with the brass mills in the Naugatuck Valley. Both of these are of comparatively recent origin. The National Brass and Copper Tube Company, located at Hastings, New York, a development from an older concern and the Michigan Brass and Copper Company in Detroit, Michigan, are entering the trade and are actively competing in the open market.*

In 1900 there was established the second brass mill to be located in the Naugatuck Valley since 1869. In 1876 the Waterbury Manufacturing Company had been organized, succeeding a manufacturing enterprise which had not been largely successful but which ran back quite a number of years in a more or less active state. The new company was well managed and in time built up a large and profitable trade in an extensive line of brass wares. It was consuming considerable amounts of metal which it cast into ingots and had rolled in other mills. In July, 1900, the Chase Rolling Mill Company, controlled by the owners of the Waterbury Manufacturing Company, began operations in Waterbury and has entered the open market for sheet brass and wire.

In 1895 there were eighteen brass mills in the country, as

*In addition to the above there are two small enterprises in New Jersey and perhaps one or two elsewhere, but none of these is of notable proportions. There are, however, two or three concerns besides those named which engage in the manufacture of a single article such as wire or tubing.

follows.* The first six were all in Waterbury, except that one, the Plume & Atwood Manufacturing Company, has its rolling mill at Thomaston, while its main office and factory is in Waterbury.

Scovill Manufacturing Company, employing... 1,600 hands.
Holmes, Booth & Haydens, " ... 1,012 "
Benedict & Burnham Mfg. Co., " ... 967 "
Plume & Atwood Mfg. Co., " ... 791 "
Randolph & Clowes, " ... 550 "
Waterbury Brass Company, " ... 525 "

The other mills in the Naugatuck Valley were:

Ansonia Brass & Copper Co., employing... 1,135 hands.
Wallace & Sons, Ansonia, " ... 646 "
Coe Brass Company, Torrington, " ... 650 "
Seymour Mfg. Co., Seymour, " ... 220 "
Birmingham Brass Co., Shelton, " ... 206 "

Also two others were located in Connecticut.

Bridgeport Brass Co., Bridgeport, employing... 750 hands.
Bristol Brass & Clock Co., Bristol, " ... 455 "

The other five outside of Connecticut were:

Manhattan Brass Co., New York, organized 1865, employing ..... 575 hands.
Rome Brass & Cop. Co., Rome, N. Y., organized 1879, employing ..... 397 "
Detroit Cop. and Brass Mills, Detroit, organized 1881, employing ..... 275 "
Chicago Brass Co., Kenosha, Wis., organized 1886, employing ..... 144 "
Brooklyn Brass and Copper Co., Brooklyn, (facts not given).

*"100 years of American Commerce", C. M. Depew, article by A. A. Cowles, Vol. I, p. 334.

At this time most of the mills rolled copper as well as brass and drew both copper and brass wire and as well handled other alloys, such as German silver and specialties. There were in addition to the above several mills in different parts of the country which handled only copper. No enumeration of these is attempted.

The hands employed as returned are for the Connecticut companies only those in the rolling mills proper; the sheet, wire and tube mills. Some of the companies had many more in the manufacturing departments; for example the Scovills employed thus about 1,000 hands in addition to those returned above.

Of the hands returned as employed, a total of 10,898, almost exactly half, or 5,445, were in the city of Waterbury, and more than half of the remainder were in the Naugatuck Valley. The total for the State of Connecticut was 9,507.

But it must be further noticed: one of the marked peculiarities of the industry is found in the fact that to a large extent the original rolling mills were led to manufacture their own product. Of the six mills in Waterbury every one at this time not only rolled metal for the market, but also manufactured, some on a large scale, its own wares. This was in 1895 likewise true of all but two of the other firms in Connecticut, the Coe Brass Company and the Seymour Manufacturing Company. On the other hand, of the five rolling mills outside of the State of Connecticut, only one, the Manhattan Brass Company, employing nearly one-half the force as returned outside of the State, remanufactured its own product.

In order to bring the list as given down to date it is necessary to remember that two of the mills have been closed. In 1903 the Coe Brass Company bought the Birmingham Com-

pany and closed its plant and in the same year the Brooklyn Company went out of business. Also in 1896 the Coe Company bought the Wallace plant and in 1901 the Chicago Company and has since operated both plants with its own in Torrington. Thus four companies have ceased separate corporate existence. The three new concerns noted as starting since 1895 must then be added, giving now a total of seventeen mills of appreciable size.

Within the Naugatuck Valley there have been times of strenuous competition. As the industry developed the different mills endeavored to secure their position by agreements regarding prices and by pooling their production. What is believed to be the earliest trade agreement in the country was here made. The earliest date which can now be given in this connection is February 10, 1853. It is believed that some mutual understanding had been reached before this time but the earliest document known to exist bears this date. The agreement was signed by every brass mill in the Valley together with the Bristol Brass and Clock Company. It may be remembered that at this time there was no effective outside competition. This earliest agreement appears to have been concerned only with prices. Shortly after however, certainly by 1856 and probably before, the mills had agreed not only as to prices, but also to regulate production. The struggle to recuperate after the crisis of 1857 gave impetus and point to the movement.

At this time, 1856, the association was very closely organized. Prices and discounts were fixed and production was apportioned and allotted. Penalties for violation were agreed upon. It was agreed that three cents should be paid into the pool by each mill for each pound of metal handled above its apportionment and any mill could draw three cents

for each pound below its apportionment which it failed to place upon the market A store was maintained in New York to which any mill could ship such products as were allotted to it and which it was otherwise unable to market.

At first Mr. George P. Cowles, at the time connected with the Ansonia Brass and Copper Company, was the executive officer of the pool, but as objection was made to him because of his connection with one of the companies interested, Mr. A. M. Blakesley of Waterbury was about 1865 made Secretary of the American Brass Association, as it came to be called. Unfortunately the most of the records relating to the various pools have been destroyed.

From 1853 until just after 1870 the organization of the American Brass Association was tolerably effective. Then came the time of greatest strain. During one year the mills would keep their agreements tolerably well and during the next competition might be much more keen. From time to time efforts were made to secure some binding agreement, sworn returns being introduced. But it often appeared that the impelling desire of each mill was to limit the operations of the others, while retaining its own freedom. During some of these years, as has been noted, some of the largest plants showed losses in operation. Still the ownership of the different enterprises remained largely in the same hands. The office force of each mill was desirous of retaining their positions and threw the responsibility of cutting prices upon the salesmen; the salesmen declared that the home office sanctioned the prices they quoted. The holders of the stock, if they failed of a dividend in one quarter, made it up in another and hence did not always take resolute action. However it was the last interest which prevented absolute demoralization. The determining factor in the various

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pools was the maintenance of prices rather than the limitation of production. From time to time certain allotments of production were made, but the closer the detail of such allotment the greater the enterprise of the different managers in changing to some slight degree the specifications. Then they reported production only as particularly specified, while they manufactured as largely as possible outside of such limit. Hence at no time after 1870 can the reported return of any mill be taken as its total output, however carefully and clearly such production may appear to be stated in the official returns. For the reason given records were not exactly kept and many books have been destroyed. Hence it is now impossible to determine the exact production of the most of the mills during this period.

Earnest efforts were made in 1876, in 1884 and in 1894 to agree as to prices and production. The price scale was generally more closely observed than the apportionment of production. The agreements were generally recognized for a couple of years, when more or less evasion appeared and they really ceased to be operative before they were formally dissolved. Since the dissolution of the 1894 pool in 1899, nothing further along this line has been accomplished.

The agreement of 1884, regulating both prices and production, was signed by every mill in the Valley, except the Seymour Manufacturing Company. The Bridgeport Brass Company and the Detroit Copper and Brass Rolling Mills were also parties to it. The only considerable concerns in the country which did not enter it were those in Seymour, Bristol, Brooklyn and Rome. And at the time the Brooklyn Company was the only one which was putting considerable amounts of sheet brass and wire upon the market. This was the last pool of which Mr. Blakesley was the Secretary.

The production as reported in pounds gross weight, of sheets, wire and tubing was as follows in 1884:

Coe Brass Company,	5,189,309
Ansonia Brass and Copper Company,	4,838,203
Benedict & Burnham Mfg. Co.,	4,760,223
Holmes, Booth & Haydens,	4,740,685
Wallace & Sons,	4,559,693
Plume & Atwood Mfg. Company,	4,282,472
Scovill Manufacturing Company,	3,207,506
Waterbury Brass Company,	2,871,180
Bridgeport Brass Company,	2,014,479
Brown & Brothers,	1,844,409
Osborn & Cheeseman Company,	1,595,463
Detroit Mill,	488,289
	40,391,911

These companies produced in that year more than 90% of the rolled brass of the country. At this time the agreement was tolerably well observed and probably the reported production was not far short of the actual production.

However the relative importance of the different mills can not be absolutely determined by the table as given. The first mill was practically exclusively a rolling and wire mill and the next four were largely devoted to rolling. Whereas the Plume & Atwood Company and particularly the Scovill Company were largely engaged in remanufacture. Probably the last named had the most extensive plant and the largest number of employees.

But the more extensive agreements to which reference has already been made were by no means the only ones which were here developed. During a considerable portion

of the period from 1865 to 1895 the Waterbury companies had certain agreements among themselves, at times of such a character that they had a large influence. These mills absolutely controlled the pool of 1884. Moreover agreements were made regarding certain specific items of production. For example, there existed at the same time as the inclusive pool, a copper rivet association, a tubing association, a lamp burner association and several others. In some instances a given plant would be a member of one of the minor pools, while declining to agree with its competitors on certain other items of production.

Regarding these pools it may be remarked that the first in 1853 is believed to be the earliest example of such an agreement to be found in the history of American industry. The conditions in the Naugatuck Valley were particularly favorable for the initiation of this experiment in industrial coöperation. The mills were not far from each other. There was no outside competition of consequence. The raw materials, copper largely and zinc to a degree, were subject to considerable and at times sudden fluctuations in price. This made it very desirable that the different companies should agree as to the differential which should be observed between the market price of copper and the selling price of the product of the mills. Moreover a given company might happen to have a large stock of copper with a rising market, which would enable it to cut prices to an extent which easily might be disastrous to other concerns. Such conditions were actually realized at times with serious results.

Further, as has been noted, in many instances the same men were interested in more than one mill. There was a real community of interest, even though this was at times obscured by the rivalry between the different companies.

Hence after the experiment of agreeing on prices and of pooling production had once been tried with its evident effect in stability of price and in the adaptation of production to the demand of the market, the tendency was ever present to return to such agreements and to confirm and extend their scope.

From time to time after 1870 there was some discussion of the feasibility of organic union of two or more of the existing corporations. No definite result appeared. On June 7, 1893, a special charter was obtained from the State of Connecticut, authorizing the formation of a new company which should include several existing corporations. The first holders of this charter were the Coe Brass Company of Torrington and the Scovill Manufacturing Company, Benedict & Burnham Manufacturing Company, Waterbury Brass Company, Holmes, Booth & Haydens, and Plume & Atwood Manufacturing Company; all of the Waterbury rolling mills except Randolph & Clowes. The Ansonia Brass and Copper Company was the only important one not in the list. But it was found to be impossible to reconcile conflicting interests.

At this time a decided difference of policy had appeared. Several of the leading factors in the trade, notably Mr. Lyman W. Coe who had been since 1863 the head of the Coe Brass Company, declared that the industry had reached such a point of development that a differentiation of function should appear. He argued that the rolling mills should confine themselves to the rolling of sheets and the making of tubing and of wire and that the business of remanufacture, the making of various wares of brass and of the other metals concerned, should be turned over to other companies either subordinate or independent. This was the most important point of difference. The Scovill Company and

L. W. Coe

Plume & Atwood were more largely remanufacturers and by means of control of patents and the trade in certain specialties they each had a large business which was not really competitive. The other four companies already named while remanufacturing to a degree were however more important as rolling mills and were moreover more close and direct competitors in the bulk of their business.

The original charter was extended in 1895 and in 1897. In 1896 the Coe Brass Company by the purchase of the Wallace plant in Ansonia became the leading corporation in the trade. On December 14, 1899, the Coe Brass Company, Waterbury Brass Company and Ansonia Brass and Copper Company came together in the American Brass Company. On August 6, 1900, the Benedict & Burnham Manufacturing Company came in and October 17, 1901, the Holmes, Booth & Haydens Company. On this same latter date the Coe Brass Company purchased the Chicago Brass Company and the organization of the American Brass Company as it is to-day was complete. The most important plants in Connecticut which are not members of this combination are the Plume & Atwood Manufacturing Company, Scovill Manufacturing Company, Randolph & Clowes, the Bridgeport Brass Company, the Bristol Company, the Seymour Manufacturing Company and the Chase Rolling Mill.

The American Brass Company is to-day the largest and most important brass making and handling company in the world. It makes more than two-thirds of all the brass used in the United States, besides which it handles much copper and various alloys, such as German silver and many mixtures the composition of which is regarded as a trade secret. It uses approximately one-third of all the copper consumed in the United States and is the largest single consumer of cop-

per in the world. The center both of its corporate existence and of its industrial activity is in the Naugatuck Valley. About one-half of its output proceeds from Ansonia, one-third from Waterbury and the remainder from Torrington. The capital of the company was at the start $10,000,000, which has since been increased to $15,000,000. Its policy is to maintain harmony of action between the constituent companies without dictating closely their internal management. With the exception of a few specialties which it controls by patent or otherwise it has abandoned remanufacture. The tendency is towards specialization of output, each plant being used more largely for such products as it can most advantageously produce.

The American Brass Company illustrates the power and efficiency of individual leadership and initiative which were so signally in evidence at the beginning of the industry; for it was brought into existence largely by the enterprise and energy of Mr. Charles F. Brooker. Mr. Brooker is a direct product of the brass industry, having begun his apprenticeship with Mr. Lyman W. Coe, who was the son of Mr. Israel Coe, one of Mr. Benedict's early partners. When Mr. L. W. Coe in 1863 bought the plant of the Wolcottville Company, the next year Mr. Brooker at the age of seventeen entered his employ. Six years later he became one of the officers of the company, succeeding in 1893 Mr. Coe in the presidency. In 1896 his company bought in the plant of Wallace & Sons and five years later the Chicago Brass Company, thus becoming the largest factor in the trade and controlling nearly one-fourth of the weight of metal in the Naugatuck Valley, and in 1899 he accomplished the organization of the American Brass Company.

The reasons why the brass industry was started in Water-

bury have been given. Water was needed for power and a plentiful supply of wood for annealing. As the industry developed large quantities of water were needed, now not so much for power as for washing the metal. As a rule every time that brass is rolled it must be annealed. After annealing the scale is removed by acid and then the metal must be washed. This consumes water in large amounts. Conditions in Waterbury were favorable in these regards. But Waterbury was not peculiar in these respects. The main reason apparently why the brass business was started in Waterbury was that it was the residence of the men who allowed their enterprise and activity to lead them on from the household manufacture of cast buttons to the larger and more promising field of rolling brass.

Two causes besides the perseverance and activity of the pioneers have acted to the end that the seat of the industry has remained in the Naugatuck Valley, where it is now established so firmly and extensively that measured by the value of its product it has become the leading industry in the State.

The first is the advantage of an early start. Brass is a comparatively high priced material. To this day the unit of production is the pound and not the ton. Also the mills early took up the manufacture of the product of their own rolls still further raising the market value of their product. This has made the industry more independent of freight charges than would otherwise have been the case. As successive difficulties were met, the need of machinery, the need of skilled workmen, the demand for capital, the question of transportation, the necessity of enlarging the market by manufacturing their own wares; these were faced and overcome by a singular exhibition of foresight, energy and skill.

The advantage secured by an early start has been maintained by the activity and ingenuity of the men whose fortunes depended upon the establishment and extension of the industry.

To-day a large plant is absolutely essential to the control of the market. Machinery has come to play such an important part in the economy of production that large expense is involved in the establishment of a new plant.

The other reason for the maintenance of the supremacy in the brass manufacture which the plants of the Naugatuck Valley have secured is that the workmen who are skilled in this particular industry are in the main only here to be found. Reference has already been had to the interdependence of the various concerns. From the beginning when the number of skilled mechanics imported from England could be easily counted to the present a substantial control of this class of labor has been maintained to a singularly effective degree. It would probably be impossible for any brass plant employing fifty mechanics to become established anywhere in the United States unless skilled men were sought and obtained in the Naugatuck Valley.

As attempts have been made from time to time to start new enterprises elsewhere it has been found necessary to appeal to the Naugatuck Valley for workmen. At times wages have been offered which were double the prevailing rates in order to secure competent help. But so well have the mills treated their employees, so many own their homes and so steady has been employment that even this inducement has seldom been sufficient to secure help of the highest grade for what was thought might be an enterprise with an uncertain future.

However, while concerns which are located in the West may be able to obtain more or less of the local business, espe-

cially as with the lowering of the margin of profit freight rates become proportionately a larger item in the cost of the product, as yet the increase of the business which has been offered has been so large that outside competition has not been severely felt by the older mills in the Naugatuck Valley. These plants to the present handle their full proportionate share of the total business. The most important refineries of copper are in the East, the manufacture of brasswares and of various productions into which brass and other alloys of copper enter more or less are established in the East and the localization of the supply of labor is still maintained.

The brass industry then began in Waterbury as an immediate development of household industry. It was there established, that being the residence of the pioneers, by their foresight, enterprise and energy in surmounting difficulties as they arose, being encouraged by the promise of sufficient financial rewards. The mills thus established in Waterbury and its immediate vicinity have maintained their position of commanding importance by the advantage of an early start, control of the market and of the available supply of skilled labor. At present the combination of capital and of labor at the command of the existing mills is such that no serious danger threatens their supremacy.

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